BOSTON REGION MPO TRANSPORTATION PLAN 2000–2025

PLAN UPDATE

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MARCH 14, 2002

Prepared by the Central Transportation Planning Staff for the Boston Metropolitan Planning Organization (MPO), which is composed of:

Executive Office of Transportation and Construction

City of Boston

City of Everett

City of Newton

City of Peabody

Federal Highway Administration

Federal Transit Administration

Massachusetts Bay Transportation Authority

Massachusetts Bay Transportation Authority Advisory Board

Massachusetts Highway Department

Massachusetts Port Authority

Massachusetts Turnpike Authority

Metropolitan Area Planning Council

Regional Transportation Advisory Council

Town of Bedford

Town of Framingham

Town of Hopkinton

THE BOSTON METROPOLITAN PLANNING ORGANIZATION REGION

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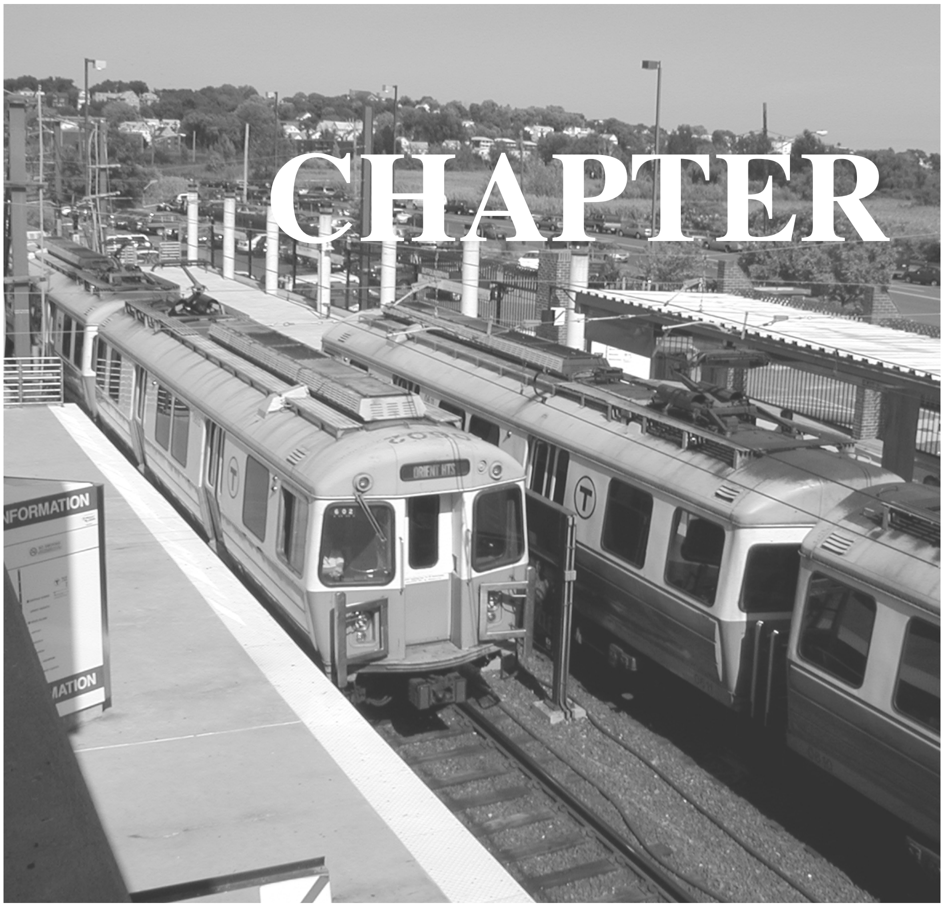


CHAPTER 1

INTRODUCTION AND GUIDING PRINCIPLES AND POLICIES

Reasons for an Update

The Federal Highway Administration (FHWA) and the Federal Transit Administration (FTA) review the planning process of each metropolitan planning organization (MPO) for recertification on a triennial basis. On March 15, 2001, the two agencies submitted their report on the recertification review of the Boston Region MPO. The Boston Region MPO planning process was recertified, subject to the completion of five corrective actions, which included the issuance of an updated Transportation Plan implementing improvements to the MPO's approach to environmental justice. The required action involves the application of measurement criteria to identify any transportation inequities; the incorporation of environmental justice findings into an updated Plan; and the dissemination of the updated Plan to low-income and minority communities to solicit input. Completion of this corrective action was required on or before March 15, 2002.

Updating the Transportation Plan also provided the Boston Region MPO with an opportunity to improve upon the work undertaken during the development of the 2000–2025 Plan. The projects included in the 2000–2025 Plan were primarily prior commitments. The update gave the MPO the opportunity to further develop its vision of the future for the Boston region. Although the development of the existing Plan featured an extensive public outreach effort, the Boston Region MPO understood that it could do more to solicit meaningful public input. In the development of the update, the MPO built upon the relationships established in the previous year and employed additional avenues for public outreach. The Boston Region MPO also reached a consensus that the policies guiding the Plan could be improved and that project selection should be guided by the revised policies.

The 2000–2025 Transportation Plan, adopted in January 2001, provided a considerable amount of information on the region's roadway, transit, freight, and bicycle system as it then existed. For the Update, the Boston Region MPO revised only those chapters that are new or have been significantly changed

since January 2001. The chapters that have been significantly altered are as follows:

- Chapter 1 – Introduction and Guiding Principals and Policies
- Chapter 2 – Plan Update Process (new chapter)
- Chapter 10 – Recommended Plan
- Chapter 11 – Forecast of the 1995 Base Case and 2025 No Build and Build Scenarios (formerly Chapter 9)
- Chapter 12 – Financial Plan (formerly Chapter 11)
- Chapter 13 – Air Quality Conformity Determination

Chapters 3 through 9 provide information on the existing conditions of the Boston Region MPO region's transportation system. These chapters were included in the Plan adopted in January 2001. The only changes to these chapters have been to update existing conditions data, if available. The environmental justice chapter in the January 2001 Plan has been eliminated because this information has been dispersed throughout the updated chapters and in Appendix A.

WHAT IS THE BOSTON METROPOLITAN PLANNING ORGANIZATION?

The Boston Region MPO consolidates transportation planning for a large portion of eastern Massachusetts and for a variety of transportation modes and facilities. By bringing together representatives from local governments, regional planning agencies, state transportation authorities, federal transportation departments and a public advisory committee, decision-making occurs in an environment that is sensitive to the diverse range of interests and concerns that exist in the Boston region.

Federal law establishes requirements and guidelines for transportation planning in urbanized areas. In order to be eligible for federal transportation funding, an area must maintain a continuing, cooperative, and comprehensive transportation planning process (3C process). This process must result in plans and programs that are consistent with the planning objectives for the metropolitan area. Section 134 of the Federal Aid Highway Act and Section 5303 of the Federal Transit Act, as amended, establish these planning requirements.

The Boston Region MPO is responsible for carrying out the 3C process in the Boston region. The Boston Region MPO covers approximately 1,405 square miles and encompasses 101 cities and towns (see Figure 1-1). It is the commonwealth's largest MPO and, with nearly three million people, it comprises nearly half of the state's population.

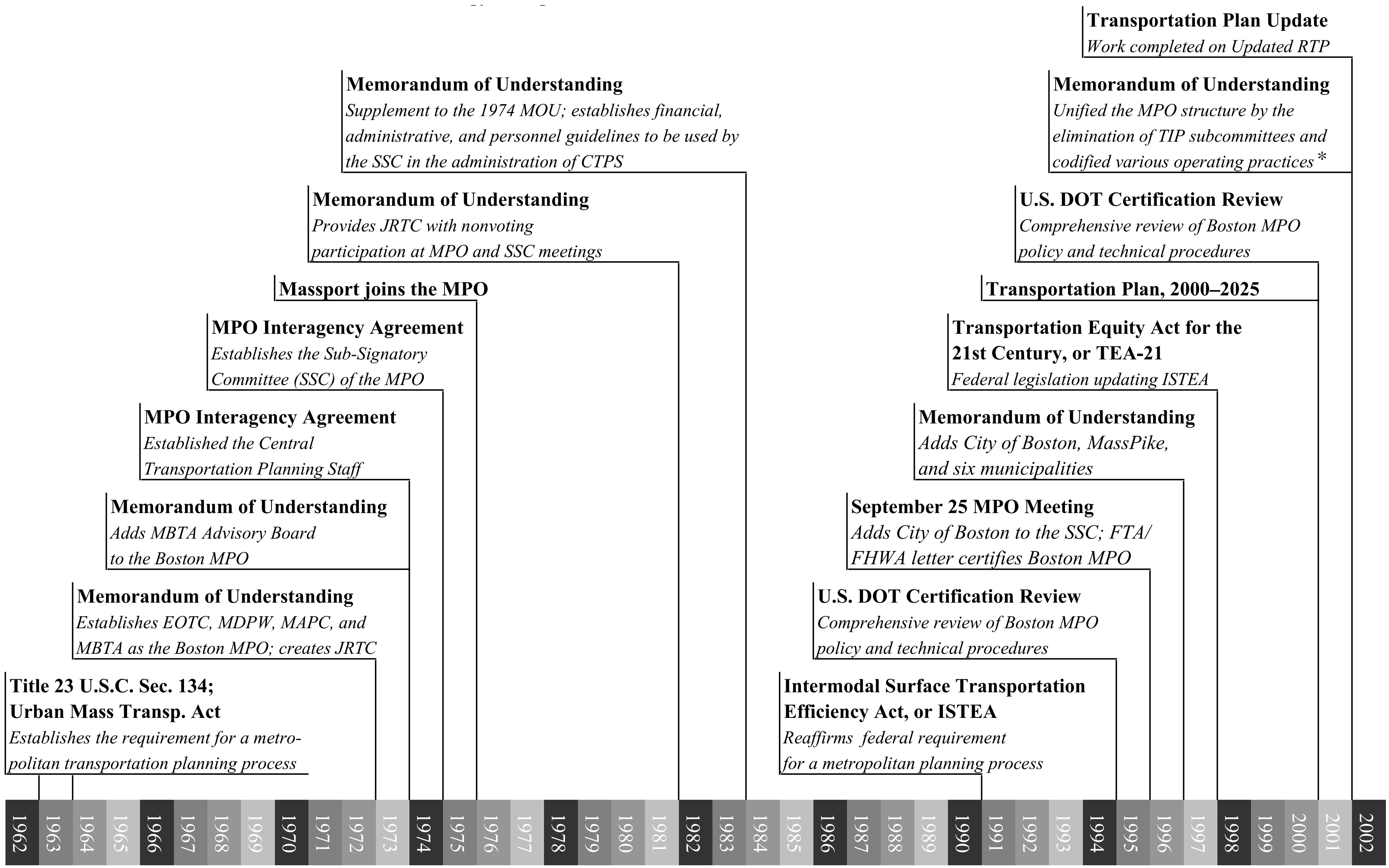
The Boston Region MPO is a cooperative board of 14 state, regional, and local entities. They are:

- Executive Office of Transportation and Construction (EOTC)
- Massachusetts Bay Transportation Authority (MBTA)
- Massachusetts Highway Department (MassHighway)
- Massachusetts Turnpike Authority
- Massachusetts Port Authority
- Metropolitan Area Planning Council (MAPC)
- Massachusetts Bay Transportation Authority Advisory Board
- City of Boston
- City of Everett
- City of Newton
- City of Peabody
- Town of Bedford
- Town of Framingham
- Town of Hopkinton

The Federal Highway Administration (FHWA), the Federal Transit Administration (FTA), and the Regional Transportation Advisory Council (previously the Joint Regional Transportation Committee) also participate on the MPO in a non-voting

FIGURE 1-1
MPO Region

Figure 1-2
Chronology of Significant MPO Statutes, Documents and Events



*The Memorandum of Understanding also renamed the SSC as the Transportation Planning and Programming Committee and the JRTC as the Regional Transportation Advisory Council.

capacity. The Boston Region MPO has established the following objectives for its planning process:

- To identify transportation problems and develop possible solutions.
- To strike a balance between short-range and long-range considerations, so that beneficial incremental actions undertaken now reflect an adequate understanding of future impacts.
- To take into account both regional and local considerations, and both transportation and non-transportation objectives and impacts in the analysis of project issues.
- To assist implementing agencies in putting MPO policy and project decisions into effect in a timely fashion with full consideration of environmental, social, fiscal, and economic impacts; and with adequate opportunity for agency, municipal and public participation.
- To assign priorities to transportation activities in a manner consistent with the region's needs and resources.
- To maintain compliance by the Boston Region MPO with the requirements of the Transportation Equity Act for the 21st Century (TEA-21), the Americans with Disabilities Act (ADA), the Clean Air Act, and Title VI of the Civil Rights Act.

Figure 1-2 is a chronology of significant MPO statutes, documents, and events.

Transportation Planning in the Boston Region

Preparation of a long-range transportation plan is a federal requirement for all metropolitan areas. Its primary use is to set regional priorities for federally funded projects. The Regional Transportation Plan is intended to serve as a comprehensive, coordinated transportation plan for all the implementing agencies within the metropolitan area. In the Boston region, its use is to set regional priorities for federally funded transit projects as well as federal and state funded road and bridge projects. The Plan is but one component of the many-layered transportation planning process. This process, by which a transportation project moves from the conceptual stage to implementation, is described below.

Project Concepts

Transit, roadway and other transportation projects begin as ideas to address a current problem or to help further some other goal. Projects can be proposed by a variety of interest groups or be the recommendation of other planning efforts such as the MPO's Congestion Management System Report and planning studies. The region's 101 municipalities may also recommend projects. The commonwealth's Governor, the General Court, state transportation agencies and the general public are other common sources of ideas for project proposals. Any projects that enter the formal planning process do so as a result of more than one of these sources. Some of the ongoing sources of projects are outlined below.

Unified Planning Work Program—The Boston Region MPO produces an annual Unified Planning Work Program (UPWP) that describes transportation planning studies to be undertaken in the Boston region during a given fiscal year. The UPWP is intended to serve two purposes. The first is to provide information to government officials, local communities, and the general public about transportation planning studies that are expected to occur in the Boston region. The second is to provide complete budget information to federal and state officials about the expenditure of federal funds for projects being carried out by the Boston Region MPO. Planning studies undertaken through the UPWP are one important source of the ideas and concepts that may evolve into actual projects through the MPO process.

Congestion Management System—The purpose of the MPO's Congestion Management System (CMS) is to improve the mobility of residents of and visitors to eastern Massachusetts. The CMS provides decision-makers with information about transportation system performance and with strategies to improve service. The CMS is a two-

part process that consists of the CMS report and CMS planning studies. The objectives of the CMS report are to locate mobility concerns and identify what planning studies, if any, may be undertaken to address them. The CMS report and associated planning studies are taken into account in the choice of projects for inclusion in the Plan.

Program for Mass Transportation—The Program for Mass Transportation (PMT) is the long-range vision program for the MBTA. The objective of the PMT is to identify and recommend projects that will result in a cost-effective mass transit system that serves the greatest number of passengers while furthering environmental and economic development goals. The MBTA is currently developing a new PMT.

Legal Commitments—Several transportation projects are legal requirements that EOTC or another transportation agency must complete within a certain timeframe. The two categories of legal commitments that have the greatest impact on planning in the Boston region today are the State Implementation Plan (SIP) and commitments related to the Central Artery/Tunnel project (CA/T).

The SIP is required as part of the Clean Air Act. It describes the efforts that a state with one or more regions in non-attainment for air quality conformity has already made and those it proposes to undertake or study to reduce levels of ozone and carbon monoxide. As a result, EOTC and transportation agencies are required to implement projects that are included in the SIP.

CA/T commitments are the result of an agreement entered into by the Department of Environmental Protection (DEP) and EOTC during the approval process for the Central Artery/Tunnel project. This agreement was recently reviewed and updated with revised implementation schedules in an Administrative Consent Order between DEP and EOTC. As a matter of policy, the MPO includes in the Regional Transportation Plan all legal commitments related to the SIP or the CA/T Consent Order.

Inclusion in the Regional Transportation Plan

Although all projects receiving federal funds are part of the MPO programming process, not all such projects must be included in the Regional Transportation Plan. The Plan's 25-year scope allows it to discuss the transportation network's future broadly, and only projects designated as regionally significant are required to be specifically referenced in the Plan. For the purposes of the Plan, the term "regionally significant" refers to projects required by federal regulations to be included in the travel demand model for air quality conformity purposes. Non-surface transportation projects such as airport expansion, harbor improvements, as well as interstate rail facilities, are examples of transportation projects not included in the Plan. For a more detailed explanation of the types of projects that must be included in the regional model see Chapter 6 – Air Quality Conformity Determination. The MPO includes particular projects in the Plan based on their ability to achieve the stated policies and goals of the Plan. In addition, FHWA and FTA require the Plan to be a fiscally constrained document. This means that the burden is on the MPO to identify sufficient funds to pay for all projects included in the Plan. This requirement means that the MPO must choose among many worthy projects.

This Plan conforms to these federal requirements by listing the "regionally significant projects" and other projects that require an Air Quality analysis. However, most other projects which will be funded in the next 25 years, on which about 70% of the available funds will be spent, cannot be specifically identified in the Regional Transportation Plan. These projects are primarily operations and maintenance projects. When it comes time to program these projects in the Transportation Improvement Program they will be selected based upon how well they implement the policies adopted in this Plan.

Inclusion of a "regionally significant project" in the Plan, although a significant step in the evolution of a project, is not the end of the process. There are several steps still remaining before the

project can be built: funding sources must be identified; it must undergo an environmental regulatory process; and the project's design needs to be completed. Projects must also be programmed in the Boston Region MPO's Transportation Improvement Program before they can be built.

Funding

The identification of funding sources is one of the most important steps in the development of a project in this age of declining government financial support. The determination of the types of funding to be sought for project implementation can also steer the project into particular channels in the planning process. If a project is capable of generating sufficient revenue to finance its own construction, the implementing agency may proceed with design and environmental permitting work, without the need to move through the MPO's programming process. Examples are Massachusetts Turnpike or Massachusetts Port Authority surface transportation projects. Projects that will be funded with only state or local money also may bypass the MPO programming process. For those projects that rely on federal funding for any part of the cost—whether it is selected by the MPO to be the recipient of formula funds, or Congress specifically appropriates funds for the project—implementation through the MPO planning and programming process is required. All regionally significant projects, regardless of funding source, must be included in the Plan and all federally funded projects, whether regionally significant or not, must be programmed in the Transportation Improvement Program (TIP). Further, in the Boston Region MPO, highway capital projects that are funded with state monies must also be programmed in the TIP.

Environmental Regulations

Most transportation projects that require inclusion in the Plan are also subject to federal and state environmental regulations. The process by which these projects move through the various stages of permitting is governed at the national level by the National Environmental Policy Act (NEPA) and at the state level by the Massachusetts Environmental Policy Act (MEPA).

NEPA requires the preparation of environmental impact statements for "major federal actions significantly affecting the quality of the human environment." A "major federal action" is defined in federal law as any "action with effects that may be considerable and which are potentially subject to federal control and responsibility." NEPA requires a federal agency, before providing a project with financial assistance, to make a finding of "no significant impact," or else require the project proponent to prepare an Environmental Impact Statement.

In Massachusetts, MEPA provides a similar framework for projects requiring certain state permits or state financial assistance. These projects must follow the MEPA review process if they meet one or more of three criteria. Projects located within a designated "Area of Critical Environmental Concern" are subject to the MEPA process. Exceeding certain threshold parameters is a second cause for entering the MEPA process. Thresholds for transportation projects typically include the following: more than 50 acres of land being directly altered; non-water dependent use of one or more acres of tidelands; more than 1,000 new parking spaces; or more than 3,000 newly generated vehicle trips per day. The final cause for inclusion in a MEPA review is that the project will require one or more specific approvals or permits, above certain thresholds. An example of an approval level relevant to transportation projects is the need for curb-cut permits to provide access to a state or MDC highway for a non-residential development, which has 200 or more parking spaces, or which generates 1,000 or more new vehicle trips per day.

The Secretary of the Executive Office of Environmental Affairs (EOEA) can also require MEPA review by making a formal finding that the project has potential to cause significant impacts on the environment. For

all projects entering MEPA review, an Environmental Notification Form (ENF) must be submitted to EOEA, a notice of which must be included in the local newspaper and in the Environmental Monitor. The MEPA office of EOEA then receives public comments on the project and determines whether an Environmental Impact Report (EIR) is required, and, if so, what issues must be addressed. Projects that exceed the threshold parameters listed above automatically must submit an ENF and EIR. A project has completed the MEPA approval process after the Secretary of EOEA has received and approved an EIR or found on the basis of the ENF that no EIR is required.

Design

Projects must also go through design review processes that are determined by the implementing agency. Although the process varies from agency to agency, they are similar in that the early stages of MEPA review result in a public hearing on the design of the project as it is currently conceived. The project design is made available to the public at least once during its development and the public has an opportunity to comment. MassHighway has a very structured design review process where the public has an opportunity to comment at the 25% design stage. The project is reviewed again at 75% design, which may, but is not required to, include additional public comments. In other agencies the process is less uniform. The MBTA, for example, does not use the same 25% and 75% design system, but presents a project for public comment at points in the design process that the Authority believes to be most useful for public input.

Federal Funding Categories

Each year, the Federal Highway Administration gives MassHighway estimates of the funds it can expect from the Federal Aid Highway Program. The majority of this funding comes in the form of apportionments from several different programs including: the Surface Transportation Program, Interstate Maintenance, Bridge, Congestion Mitigation and Air Quality, and National Highway System. MassHighway, in turn, provides each of the MPOs and regional planning agencies of Massachusetts with a target for federal highway funds to be spent in their region.

On the transit side, the Federal Transit Administration informs the MBTA of the expected availability of federal transit funds. The majority of federal funds received by the MBTA are in the form of Section 5307 funds, which can be used for any transit capital expense, and Section 5309 funds. Section 5309 funds consist of Bus Discretionary, Rail Modernization, and New Starts funds. New Starts and Bus Discretionary funds are specifically earmarked for certain projects by Congress, while Rail Modernization and Section 5307 funds are dispersed on a formula basis.

Transportation Improvement Program

After the Boston Region MPO ascertains the amount of funding that it can program for projects within the region, the process of programming projects for the Transportation Improvement Program (TIP) can begin. The Executive Office of Transportation and Construction (EOTC) and MassHighway develop federal and non-federal aid targets for the TIP in an open and cooperative statewide setting which involves the MPOs and RPAs. The state is responsible for explaining how targets are derived and for providing additional information as requested.

The TIP is a staged, multi-year, intermodal program of transportation projects which is consistent with the Plan. In order to be eligible to receive federal funds, a project must be programmed in the current fiscal year's TIP. Most highway projects funded with state transportation money are also included in the TIP in the Boston region. The programming of projects in the TIP is based upon regional priorities, as well as the readiness of projects to begin construction. Once a project is programmed for inclusion in the first year of the TIP, it can be advertised; bids can be accepted; construction contracts awarded; and actual work on the project can begin. Even after programming in the TIP, however, construction of

a project is still contingent upon the completion of design and permitting work.

Advertising for Construction

While each agency at the state level advertises construction specifics differently, the overall advertising process is generally uniform. As part of the final pre-construction work on a project, design departments prepare a "Notice to Bidders." Once this is prepared, it is sent to a contract administration department for review and from there it is forwarded to other appropriate departments, such as the Legal Department, the General Counsel, and finally to the General Manager or Commissioner of the agency. After receiving final approval, the "Notice to Bidders" is sent to specific publications, depending upon the size of the contract, for advertisement, as well as placed on the specific agency's web-site. From there, bids are received, reviewed, and processed and a final contract awarded to a specific construction company or firm. There are some types of projects, however, that are not advertised. Transportation demand management (TDM) projects and operating costs are two examples of projects that are not advertised.

Guiding Principles and Policies for the Plan Update

The Transportation Plan Update recognizes the diversity of transportation needs and issues throughout the Boston region and attempts to respond to them in a balanced manner. This Plan sets the policies, selects the regionally significant projects, and identifies the actions necessary to serve all modes of transportation for persons and freight in this metropolitan region and by so doing, attempts to address the issues of congestion and sprawl while supporting economic vitality and environmental justice.

While advocating a transportation system that adequately serves all modes of travel, the Plan recognizes that many people of the region are reliant on the automobile and will continue to be over the life of the Plan. Indeed, we expect both roadway congestion and the demand for transit to increase in the future. The Plan also recognizes that many possibilities exist to reduce our need to drive. Changing our transportation pricing policies or land use practices are two such possibilities. The Plan also stresses the need to develop a transportation system that expands our choices for travel within the region.

Sprawling development is wasteful of limited infrastructure dollars and detrimental to the quality of life which is an essential component of our economic competitiveness. Consequently, this Plan is generally consistent with MetroPlan, the adopted land use plan for the Boston region.

The Plan also seeks to provide access to transportation services on an equitable basis across the region. This includes, but is not limited to, ensuring that low-income and minority communities have transportation options to travel to jobs and that transit-dependent residents can reach needed services across the region.

Finally, the Plan recognizes that the transportation system plays a critical role in the continued economic health of the region. Many sectors of the regional economy depend heavily on the safe and efficient movement of goods and services by truck, rail, air, and water.

There have been some significant changes to the policies during the development of the update. Policies 6 and 7 were created out of a single policy from the 2000–2025 Plan in order to place more emphasis on the MPO's efforts to address environmental justice concerns. Policies 11 and 12 are new policies that address community preservation and financial planning, respectively. In addition, more consideration was given to the methods by which the goals of each of the twelve policies can be accomplished.

The following Boston Region MPO policies and strategies are applicable to all MPO activities, with particular emphasis on the Regional Transportation Plan, the Transportation Improvement Program, and the Unified Planning Work Program. Though numbered for reference purposes, the policies are not prioritized.

Policy 1: Promote transportation projects that support state, regional and local land use policies.

Integrating transportation and land use policies can result in more efficient use of the regional transportation system, bringing jobs, housing, shopping and services closer together, and reduce sprawl.

To accomplish this policy, the Boston Region MPO will:

A. Consider both existing development and densities and any adopted state, regional and local plans in transportation decision-making and seek to develop transportation plans that are consistent with them. Priority will be given to projects in areas identified in local and regional plans as being suitable for concentrated development.

B. Solicit the input of environmental, community, economic development and other appropriate agencies on MPO certification documents to promote the integration of transportation with these interests.

C. Consider the impact of transportation projects on existing and future land use.

D. Consider the appropriate use and maintenance of transportation rights-of-way to maximize public benefits.

E. Encourage transportation investments that support transit-oriented designs, and increased potential for walking and bicycling.

Policy 2: Improve safety and security for all transportation system users.

Travelers should be confident of a safe and secure trip. Safety can be enhanced through careful attention to design, redesign, and upgrading of facilities. Operational safety can be enhanced through timely and effective maintenance.

To accomplish this, the Boston Region MPO will:

A. Support designs, projects, and programs that accommodate safe travel for all system users throughout the transportation network, regardless of mode. This includes designs that encourage bicyclists, motorists, transit riders and pedestrians to share the transportation network safely.

B. Work with state agencies and communities to support design concepts that ensure that consideration of operational efficiency as well as the comfort, safety and convenience of the motorist are balanced with the needs of the communities, the environment, pedestrians, and bicyclists.

C. Support maintenance and operations of system infrastructure to provide for safety.

Policy 3: Improve transportation mobility for people and freight.

Improved mobility requires access to the transportation system and the availability of safe, reliable, and convenient travel options so that users can choose the services that best fit their needs.

To accomplish this policy, the Boston Region MPO will:

A. Support projects that increase the availability of transportation options.

B. Encourage projects that reduce reliance on single-occupant vehicles.

C. Support projects and programs that improve transit service by making it faster, more reliable, and more convenient.

D. Support transit services, including water transit, that increase and complement connections among transit services and communities.

E. Assist agencies and communities in planning and implementing projects that provide safe and convenient bicycle and pedestrian connections to transit routes, between activity centers, and across communities.

F. Support programs that improve reverse commute options.

G. Plan and support transportation system management projects and programs that improve the operation of existing services such as

improved signal systems, bus rapid transit, bus lanes and traffic signal preemption, and incident management programs.

H. Encourage the use of new technology and programs, including highway and transit Intelligent Transportation System programs and bus rapid transit, to improve the operation of the transportation system as well as safety, and reduce congestion.

I. Support projects that expand transportation system capacity in areas that are identified as problems in the Boston Region Congestion Management System and as dictated by sound fiscal management. Transit capacity may be expanded by increasing service frequency, expanding vehicle capacity, or expanding the system. Highway capacity may be increased by improving interchanges or adding HOV lanes. Adding capacity by building general-purpose lanes should be considered only when no demonstrably better solution such as public transportation can be found.

J. Expand commuter rail parking where necessary and practical.

Policy 4: Minimize transportation-related pollution of the environment and promote energy conservation.

This plan recognizes that reduced reliance on single-occupant vehicles and use of alternative fuel vehicles promote long-term air quality, reduced energy consumption and natural resource protection.

To accomplish this policy, the Boston Region MPO will:

A. Place a priority on identifying and evaluating environmental impacts in the transportation planning process.

B. Encourage projects and programs that increase the use of low-polluting fuels and efficient engine technology in transit and highway vehicle fleets.

C. Encourage the design and construction of facilities that assure that materials used in operations and maintenance will not have detrimental impacts on soil and water, and will minimize light and noise pollution.

D. Encourage the design, construction, and operation of facilities and services that promote energy efficiency and air quality.

E. Plan and fund programs to reduce demand for transportation services and facilities, including ridesharing and employer-based congestion reduction programs.

Policy 5: Provide and improve connections among transportation modes.

This Transportation Plan promotes a multimodal, comprehensive approach to transportation, with the various modes complementing each other. Investment choices should be influenced by how an improvement to a single transportation mode can make the entire system work better.

To accomplish this policy, the Boston Region MPO will:

A. Work to improve coordination among the local, regional, and state jurisdictions that own and operate the region's transportation system to better provide for local and regional transportation needs.

B. Fund projects, such as vehicle and bicycle parking expansion, that provide additional capacity at intermodal facilities.

C. Support projects that facilitate ease of transfer between modes, including improved fare collection systems and transit pass programs, and encourage transit schedules that promote timely transfers between services.

D. Fund systems that provide intermodal information on incidents, alternative routes, parking availability, and transit schedules.

E. Support projects and programs that improve access to transportation facilities.

Policy 6: Provide a transportation system that is accessible to all people.

The transportation system should provide access to transportation options for all people regardless of physical limitation, economic status, age or ethnicity.

To accomplish this policy, the Boston Region MPO will:

A. Work with local, regional, and state jurisdictions to identify and assess structural and operational barriers to mobility for transportation disadvantaged populations and seek to address them through a comprehensive program of construction, maintenance and operational improvements.

B. Seek to provide better access for all to transportation throughout the region, including our youth and our elderly and disabled users.

Policy 7: Promote the equitable sharing of the transportation system's benefits and burdens.

All users and communities should be treated fairly in the provision of transportation services. They should not be inequitably burdened by impacts from transportation projects and they should be invited to participate in transportation decision-making.

To accomplish this policy, the Boston Region MPO will:

A. Adopt measures of Environmental Justice for the region.

B. Use these Environmental Justice measures as an evaluation tool in planning and programming.

C. Apply planning resources to the resolution of identified environmental justice issues.

Policy 8: Emphasize the preservation and modernization of the existing transportation system.

Past investment in transportation facilities in the Boston region has resulted in a system that people and businesses rely on every day. Protecting that investment by preserving and upgrading facilities and services that meet a demonstrated need is a top priority.

To accomplish this policy, the Boston Region MPO will:

A. Put priority on projects that maintain and modernize existing infrastructure.

B. Promote public ownership and use of existing rights-of-way necessary for transportation needs consistent with statutory authority or other obligations providing for disposition of property.

Policy 9: Promote public involvement in all phases of transportation planning and design.

All users of the transportation system should have a voice in the transportation planning process. Public participation will continue through the Regional Transportation Advisory Council (Advisory Council), the MPOs public advisory committee, and through other, complementary avenues.

To accomplish this policy, the Boston Region MPO will:

A. Adopt, in cooperation with Advisory Council, a new MPO Public Participation Plan that provides all users of the transportation system with the opportunity to participate in the transportation planning process.

B. Use extensive and effective means to reach users, including meetings and various media, always presenting information in a clear, jargon-free format.

C. Work to simplify the project review process by: establishing review timelines and deadlines, providing updated status information regularly, and working with implementing agencies to ensure that all communities understand the process.

D. Continue to work with the Advisory Council in the development of all MPO documents, and support the Advisory Council's work of bringing the public's views to MPO decision-making.

E. Reach out to under-represented persons and groups to ensure that decisions are made through an open and participatory process.

Policy 10: Strengthen the economic opportunities in the Boston region through transportation investments specifically taking into account areas targeted for economic development by state, regional and local plans.

The transportation system is fundamental to and intertwined with economic activity.

To accomplish this policy, the Boston Region MPO will:

A. Put priority on transportation investments related to existing centers of economic activity; or to areas with adequate water and sewer infrastructure; or to areas targeted for economic development.

B. Coordinate available data on freight movements in the Boston region in order to inform MPO decisions on infrastructure investments.

C. Encourage development of a comprehensive plan for freight movement that includes an evaluation of freight infrastructure needs and access to intermodal facilities (air, road, rail, and water), and considers impacts on neighborhoods and the environment.

Policy 11: Support the preservation of community resources and character in the transportation planning process.

To accomplish this policy, the Boston Region MPO will:

A. Encourage and support transportation enhancement projects to preserve and improve the natural and built environment.

B. Support the use of traffic calming when appropriate.

C. Work with state agencies and communities to support design concepts for roads that balance the needs of users of the facilities with the function and character of surrounding land uses, including scenic roads and historic areas.

Policy 12: Efficiently and effectively secure and apply financial resources for the maintenance, modernization, and appropriate expansion of the regional transportation system.

The Boston Region MPO has an obligation to provide maximum transportation benefit from its available financial resources and to explore and identify innovative financing options for transportation projects.

To accomplish this policy, the Boston Region MPO will:

A. Work to identify and acquire new revenue for transportation.

B. Explore and identify innovative funding sources including revenue-sharing among communities and peak-period pricing.

C. Promote new public/private partnerships as a way to provide needed services.

D. Work with implementing agencies, communities and project proponents to identify and adopt policies, procedures and information systems to estimate and contain project costs.

CHAPTER 2

PLAN UPDATE PROCESS

The Federal Highway Administration and Federal Transit Administration approved the Boston Region MPO's 2000–2025 Transportation Plan in January 2001. The MPO developed the 2000 Plan in recognition of the fact that the long-range planning process was ongoing, and that it would prepare an update to the approved Plan. In addition to developing a recommended project list that went beyond the legal commitments and previously committed projects identified in the 2000 Plan, the MPO promised several other efforts, including:

- An improved set of guiding policies for the Boston Region MPO would be developed.
- The public outreach efforts to provide opportunities for input at each stage of Plan development would be expanded.
- The Boston Region MPO's efforts to address environmental justice concerns, with a specific focus on the continued work of the MPO Environmental Justice Ad Hoc Committee would have greater emphasis.
- A recommended plan of long-range projects with the MPO's revised policies serving as an additional tool for evaluating and selecting projects.

As described in Chapter 1, the triennial re-certification of the Boston Region MPO's planning process had several implications for the MPO. Two of these were corrective actions that specifically dealt with environmental justice. In addition to the MPO's own commitments for the Plan update, FHWA and FTA recommended that the environmental justice corrective actions be addressed within the context of the Plan.

Policy Development

The MPO devoted a considerable amount of time toward the development of guiding policies during the 2000 Plan process. There was consensus, however, that more could be done to refine the policies so that they could better guide the selection of projects. In April 2001, the Transportation Planning and Programming Committee (formerly known as the Sub-Signatory Committee) created a policy subcommittee to consider both public comments and MPO concerns, and to refine the Plan's policies to better match the region's goals and priorities. The subcommittee completed its work during the summer, and in July 2001 the Transportation Planning and Programming Committee approved the policies for the region. New language pertaining to community preservation and financial planning was added and the emphasis on environmental justice was heightened. A detailed description of these policies, with recommendations on how to meet specific goals suggested therein, was provided in Chapter 1.

Public Outreach

Public Outreach

The MPO implemented an aggressive program of public involvement for development of the Plan Update. The program included a variety of forums and actively sought to bring new participants into the regional transportation planning process.

It began early in the process with discussion of the Plan Update at several community and subregional meetings in the spring and summer of 2001. In April, for example, MPO staff participated in the day-long community forum, "Environmental Justice in the 'Hood 2001" in Roxbury and discussed the Plan Update with the MetroWest Growth Management Committee Transportation Task Force in Framingham. In addition, the MBTA provided a forum for the dissemination of information on the Plan Update at its fall 2001workshops on the Program for Mass Transportation. Finally, the Boston Society of Civil Engineers provided a forum for a briefing at its November 2001 luncheon.

The public outreach process continued with the fall 2001 MPO workshop program, which was comprised of six workshops and one regional meeting. Workshops were conducted in all corners of the MPO region and were planned to maximize interaction and in-depth discussion among participants. Discussion ranged from policies, to projects, and to the regional transportation planning process. Participants responded with numerous verbal and written comments. They also provided guidance using pre-prepared checklists and questionnaires. The MPO found this interactive meeting format to be useful for gathering substantive input and it was interesting for citizen participants. The MPO asked several community-based and professional organizations and the Chairman of the legislature's Joint Committee on Transportation to co-sponsor the workshops as a way to broaden the participation and variety of views. This approach was successful and will continue in future MPO public involvement initiatives.

The Regional Transportation Advisory Council (formerly known as the Joint Regional Transportation Committee) discussed the Plan Update at its monthly meetings between October, 2001 and January, 2002. They also convened a subcommittee to review the Plan Update and assist the Advisory Council in making recommendations to the MPO. Recommendations were sub-

mitted to the Transportation Planning and Programming Committee at its December 20, 2001 meeting.

MAPC subregions provided another opportunity for presentations on the Transportation Plan and for interaction and input from local municipal representatives. The eight subregions provide a forum for discussion of their interests within a regional context. The subregions discussed the Plan Update throughout the fall and early winter. Members provided input and guidance on plan policies, the Universe of Projects, and project selection. The subregions made comments during their meetings and many also submitted written comments.

The MPO also relied on its newsletter, *TRANSREPORT*, to provide the public with information on the Plan Update. *TRANSREPORT* reaches more than 2,500 individuals and organizations, such as municipal elected officials, transportation committees, neighborhood and special interest groups, individual citizen activists, and local libraries. MPO notices and reports published in *TRANSREPORT* receive wide circulation to a well-targeted population with a history of interest in transportation issues. Other notices and information were provided by press releases, which were distributed to every major newspaper, most local newspapers in the region and newsletters of professional organizations. Notices were also sent via direct mailings and faxes. Information has also been posted on the MPO website at http://www.ctps.org/bostonmpo.

IMPACT OF PUBLIC COMMENT

MPO outreach for the Transportation Plan has resulted in substantive and useful comments, many of which have impacted the Plan Update. Since the Plan is financially constrained, not all suggestions and projects put forward by the public can be implemented, but all provide valuable information. Each comment is summarized and given a response, and is included in Volume 2 of the Plan Update. They will also be reviewed as part of the development process for the next Regional Transportation Plan and the FY 2003 Unified Planning Work Program.

Public comments can be grouped into three main topic categories: policy, project-specific, and document preparation.

Members of the public advanced numerous (though sometimes conflicting) ideas. Regarding policy issues, they urged the MPO to:

- Select projects that promote transit and alternative modes of transportation, reduce environmental impacts, and improve air quality and the quality of life in communities.
- Address the region's serious traffic congestion.
- Expand parking at transit stations and stops.
- Emphasize improvements that address environmental justice issues.
- Make transportation investments in areas not yet served by transit. This includes intra- and inter-community transportation and accessible transportation in suburban areas.
- Guide transportation investments to transit-oriented development and to areas where the existing water, sewer, and roadway infrastructure can accommodate growth. (They noted the basic tension inherent in this position since development issues are local zoning issues and driven by market demand.)
- Consider highway capacity projects that include adding new general–purpose lanes only after all other projects and sustainable transportation options have been determined to be infeasible.
- Identify new sources of revenue for public transportation. In addition, they recommended that funding for transit projects be increased either by expanding the proportion of funding for expansion projects or by reducing funding for highway projects.

Citizens and officials most frequently spoke in support of specific projects. Sometimes they opposed certain projects. They supported the following projects that are included in the Plan

Update: the Green Line Extension to Medford Hillside, Urban Ring Phase 1, Assembly Square Orange Line station, the New Boston Street Bridge, I-93 and I-95 Interchange Improvement projects, Route 128 Add A Lane, Telecom City, East Boston Haul Road, the South Weymouth Naval Air Station Connector, Route 18 Improvements, and Route 3 South Widening. Some citizens did not support the New Boston Street Bridge and the Route 3 South Widening.

Members of the public also suggested that specific projects be added to the recommended list of projects, including: Light Rail on Washington Street, Urban Ring Phases 2 and 3, extensions of the Blue Line to Lynn and Salem, the I-93/Mystic Avenue Interchange and the North-South Rail Link.

They expressed a desire to include regionwide projects such as: 100 additional buses, additional transit and commuter rail parking, bus service improvements and new routes, reverse commute services, intra- and inter-community shuttle services that provide service to transit and between transit and employment destinations.

Citizens also supported extensions of the Fitchburg Line and other commuter rail lines, improved Green Line service, water transportation service improvements, better signing on city streets, parking and pedestrian access improvements at Alewife, additional bicycle paths with connections to transit facilities, and improvements to the Braintree Split.

There were several suggestions for document preparation. Some citizens felt that:

- MPO policies should be used to guide the selection of projects for the Plan Update.
- The policies are too broad and should be more specific to be an effective tool for project selection.
- More information on projects should be made available.
- The public should be involved earlier in the process to allow more time for review and consideration.
- Projects and their needs and benefits should be compared on a regionwide basis.
- Evaluation should be based on objective criteria.
- Additional discussion of the region's vision, goals, and approaches to major regional issues should be included.

Environmental Justice

As a matter of policy and equity, the MPO worked to ensure that environmental justice was served by the Plan Update process. Federal, state, and local agencies as well as community activist groups demanded that the MPO take into account the voice of traditionally under-served constituencies including communities of color, low-income residents, and transit dependent populations. The MPO solicited views from these communities, organizations and individuals throughout the update process and will continue to broaden its outreach in this area.

The Boston Region MPO has undertaken a program to bring new participants into the transportation planning discussions and to weave environmental justice perspectives and elements throughout its transportation planning process. The MPO convened the Environmental Justice (EJ) Ad Hoc Committee, made up of representatives of community or interest groups from minority and low income neighborhoods. This group met twelve times in 2001 to create a definition of environmental justice, to develop criteria for measuring environmental justice, to identify projects that were important to the environmental justice committee, and to discuss how transportation planning in the Boston region can consider and act on environmental justice issues. The Environmental Justice Ad Hoc Committee will continue to meet to provide ongoing input and to monitor implementation of environmental justice measures. In addition, the MPO will continue its efforts to meet with the group's constituent organizations at their regularly scheduled meetings to report directly to the broader community about MPO efforts to address environmental justice.

Definition

The following definition of environmental justice has been adopted by the Boston Region MPO:

Environmental Justice requires the MPO to:

- examine the allocation of benefits and burdens, currently and in the planned future.
- ensure that minority and low-income communities are treated equitably in the provision of transportation services and projects.
- provide full participation for minority and low-income communities to advise the MPO during its planning and decision-making process.

The examination of Environmental Justice will include consideration of patterns of capital investment and allocation that have contributed to present conditions and inform current and future MPO decisions.

Measures

Regarding the measurement of Environmental Justice, the Ad Hoc Committee has been primarily interested in transit issues. As articulated by its members, many people who live in low-income and minority neighborhoods are transit-dependent, and improvements in transit are of paramount concern. The discussion about roadways was more centered on perceived burdens.

The Boston Region MPO will use the following performance measures to address transit services:

- vehicle load.
- frequency of service.
- schedule adherence.
- transit amenities (including shelter availability).
- vehicle assignment (age, air conditioning, emissions profile).

Information on these measures is provided in Appendix A. Each of these measures will be used to compare the relative level of service in communities regardless of mode.

In addition to these performance measures, the MPO developed a measure of transit mobility. The MPO, assisted by the Environmental Justice Ad Hoc Committee, selected 18 origin points and 14 destination points. The origin zones include low-income and minority areas and non-low income and non-minority areas, while the destination zones were selected to include high-employment areas (with large numbers of service jobs), hospitals, and schools. Using the regional model, the MPO examined travel times, travel distances, and travel speeds between each of these points and each of these destinations. These model outputs for the current system and a memorandum documenting the methodology for choosing origin and destination points is included in Appendix A.

In measuring the Environmental Justice impacts of roadways, MPO staff had considered the idea of measuring mobility, but did not think it would yield useful results, given the near-universal access to the roadway network. The Environmental Justice Ad Hoc Committee, moreover, was primarily interested in highway measures that would indicate the effect of a roadway on a neighborhood. As a result, the MPO, with input from the Ad Hoc Committee, has developed the following roadway measures:

- safety of the roadway network for all users (vehicle, bicycle, pedestrian).
- condition of the infrastructure, including bridges.
- impacts of the network on "host" neighborhoods.
- assessment of benefits provided.

Consistent with the views of the Ad Hoc Committee, these measures are primarily geared toward a project-specific or facility-specific review, as opposed to a systemwide analysis.

In addition to the transit and roadway measures outlined above, the Environmental Justice Ad Hoc Committee has stressed the need for the MPO to assess proposed investments to determine whether low-income and minority communities are receiving a fair allocation of available

resources. The MPO has agreed to examine planned capital expenditures to identify which communities or neighborhoods would benefit from, or be burdened by, proposed investments. The MPO, with the assistance of the Environmental Justice Ad Hoc Committee, will then attempt to quantify and address any discrepancies between targeted populations (low-income and minority communities) and non-targeted populations.

Views of the Environmental Justice Ad Hoc Committee are incorporated throughout this Plan Update and will be reflected in the transportation policies and future planning activities of the Boston Region MPO. However, the MPO has not adopted all of the recommendations made by the committee. The committee supported the following transit projects for inclusion in the Plan Update: service improvements on the Fairmont Branch; the reinstitution of Arborway Green Line service; the extension of Green Line service to Medford Hillside; the purchase of 100 additional clean-fuel (non-diesel) buses; and the institution of light rail service on Washington Street from Dudley Square to Park Street. This Plan includes the first four projects but does not include the latter one. A memorandum documenting the committee's recommendations is included in Appendix A.

Universe of Projects

One of the primary outcomes of the Regional Transportation Plan is the development of a list of major capital expansion projects for implementation over the next 25 years. To select these projects, the MPO first created a Universe of Projects – a list of all possible projects for selection. The Universe of Projects, which can be found in Appendix B, comprises projects included in a previously adopted Regional Transportation Plan; projects previously studied, under study or in development; projects included in comments received on the 2000 Plan; and projects identified through the Plan Update planning process in 2001.

Tying Policies to Projects

A matrix was created to help define the relationship between policies and projects. Each project included in the Universe of Projects was rated on its impact to ten of the twelve policies. The two policies not rated (public involvement – Policy 9 and innovative financing – Policy 12) are not applicable to this exercise. This matrix and an explanation of the rating system are found in Appendix C.

Selection of Land-Use Assumptions

As part of the process for developing the 2000-2025 Regional Transportation Plan Update, the MPO projected what the land use will be in the year 2025. The process of selecting land use scenario assumptions began with a discussion of alternative land use and transportation scenarios at public meetings that were held around the region in 2000 and which continued into 2001. The scenarios discussed at these meetings encompassed both a vision of the future and land use policies and transportation strategies that will help us achieve that vision.

Three land use scenarios were originally developed by MAPC. These scenarios do not predict actual changes in land use in the region; they merely allocate forecasts of population, households, and employment, by Traffic Analysis Zone (TAZ) out to the year 2025. The Basic Forecast land use scenario assumes that population, households, and employment will follow the general pattern of growth observed for the last 20 years. The Water and Sewer Constraints land use scenario allocates future population and employment growth to communities with the water supply and wastewater infrastructure to accommodate it. A policy of allocating growth to denser areas with available water, sewer and transit infrastructure is the basis for the Targeted Growth land use scenario.

Please note these scenarios are based on trends that are modified by certain assumptions, not solely projections.

- Basic Forecast – past growth areas will continue to be attractive; existing resources and infrastructure constraints are overcome and do not limit development; and large numbers of people will move to, or commute into the 164 modeled communities in response to large numbers of new jobs. (Figure 2-1)
- Water and Sewer Constraints – water and sewer constraints will restrict development or make it too expensive in most communities; new technology will not significantly negate this constraint; and conservation programs will not significantly reduce total demand under current levels. (Figure 2-2)
- Targeted Growth – growth will occur in areas with adequate water and sewer capacities and transit infrastructure. (Figure 2-3)

A detailed description of how the three land use alternatives were developed is included in Appendix H.

These three land use alternatives were originally developed by MAPC. However, the MPO decided to use only the Basic Forecast and the Targeted Growth scenarios for use in modeling. The Water and Sewer Constraints alternative was dropped because most of its assumptions were incorporated into the Targeted Growth scenario. Therefore, the model results shown in Appendix D only include the two land use alternatives.

Selection of Transportation Networks

The MPO used the Universe of Projects as a source for selecting projects for modeling in the 2025 Build Scenarios. The Plan Update modeling process combines selected transportation projects with land-use assumptions to produce forecasts of transportation use for three milestones: the 1995 Base Case, the 2025 No-Build Scenario and the multiple 2025 Build Scenarios. The results of the regional travel demand model are one of the inputs used by the MPO to determine the merits of possible projects. In addition to these results, the MPO also received information produced on projects through feasibility studies, project-specific modeling work, and environmental impact reports. This modeling information can be found in Appendix D. One final input into project selection was the review of each project for conformity with the MPO's transportation policies. Using these inputs, the MPO developed three transportation project lists for modeling. The three model alternatives were developed based on the "information produced" (meaning projects were eligible to be included if there was sufficient project information to do network coding, and if a cost estimate existed). Projects for which this information was not available were not included in the project lists. Although several individuals looked at the conformance of projects to plan policies, this information was not actively used to select the project lists.

Alternative One segregated funding by use; highway revenues were used exclusively for highway projects and transit revenues were used for transit projects. Highway projects were selected on the basis of regional needs, with consideration given to geographic equity. Transit projects were selected to maintain legal commitments and make improvements to the existing system.

Alternative Two was based on an attempt to target growth, combined with an underlying policy that projects that increase highway capacity should be undertaken only if no other feasible option is available. Highway projects were selected based upon location and their use in channeling growth to desired locations. Transit projects were selected to maintain legal commitments and to channel growth to desired locations. In this alternative, $430,100,000 in highway funds was assumed to be flexed to transit projects over 25 years.

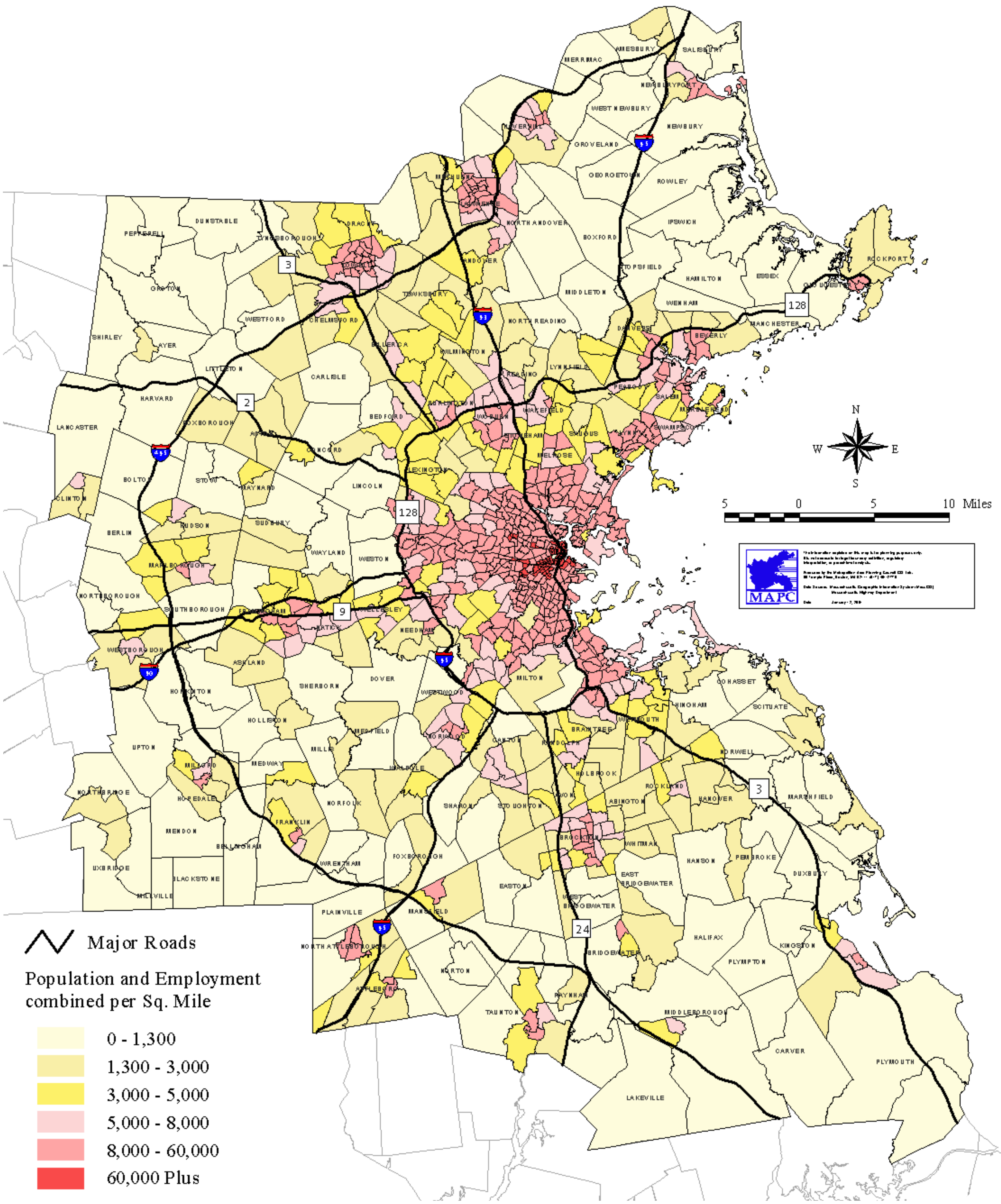
Alternative Three was developed to provide model results for some high-interest projects that had not been included in either of the two previous alternatives. Six additional highway projects were selected based upon public input, future year model forecasts, and agency recommendations. Two additional transit projects were included based, in large part, upon the recommen-

dations of the MPO Environmental Justice Ad Hoc Committee.

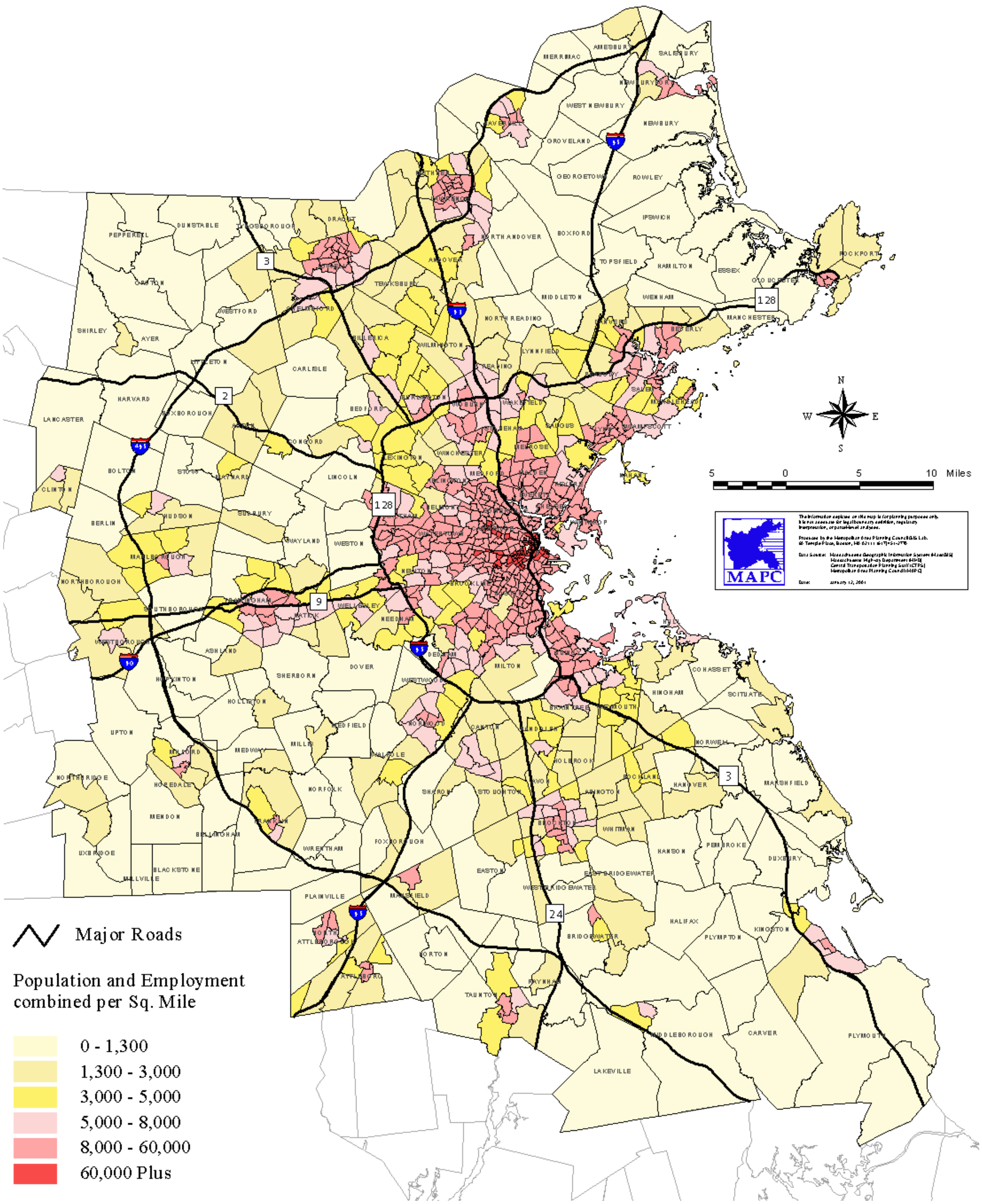
The listing of the projects in the three alternatives is included in Appendix E. The final recommended project network also segregated funding by use; highway revenues were used for highway projects and transit revenues were used for transit projects.

The model results for these three transportation alternatives, applied to the two land use scenarios, are summarized in Appendix D.

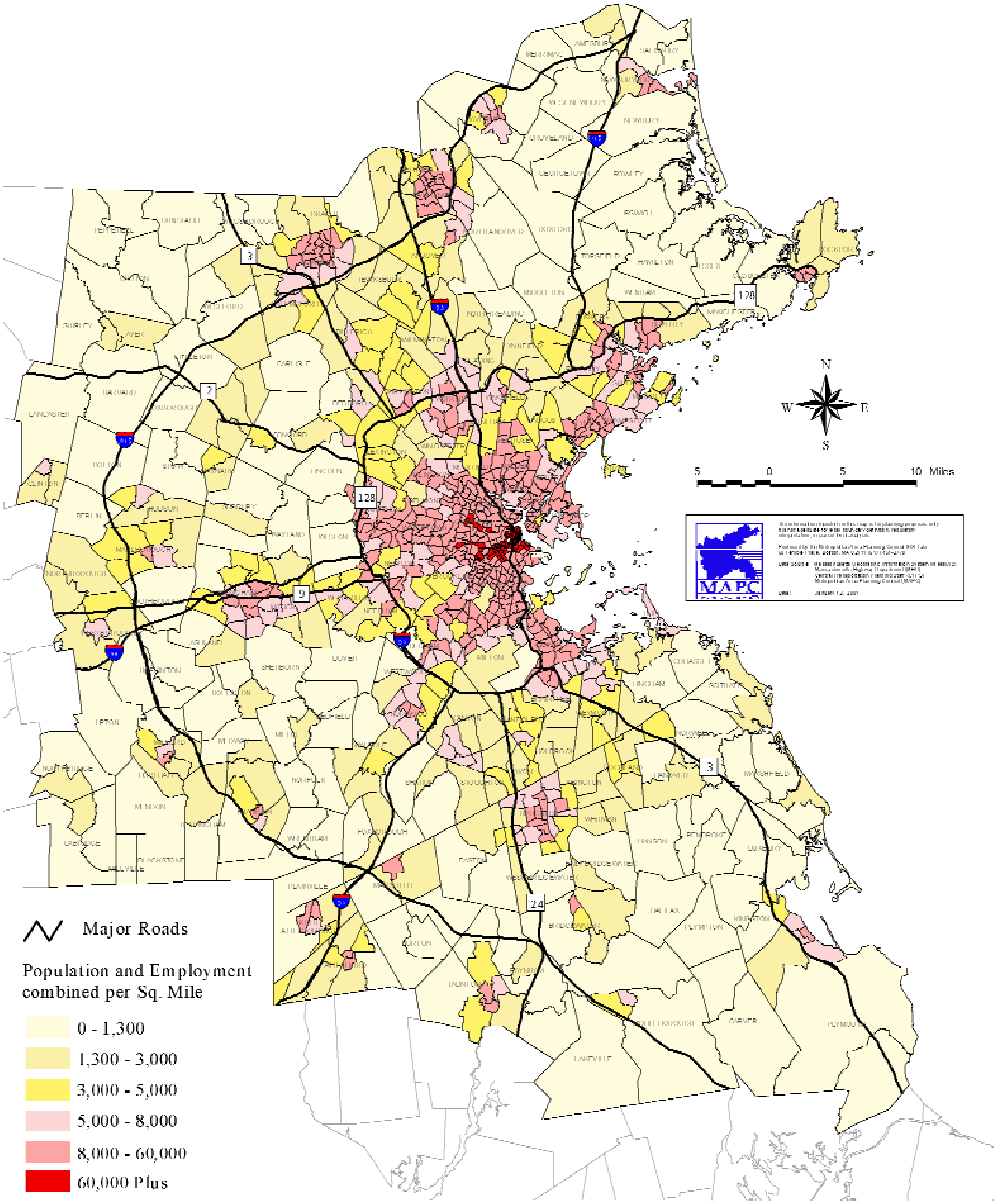
MAP 2-1
Basic Forecast Map

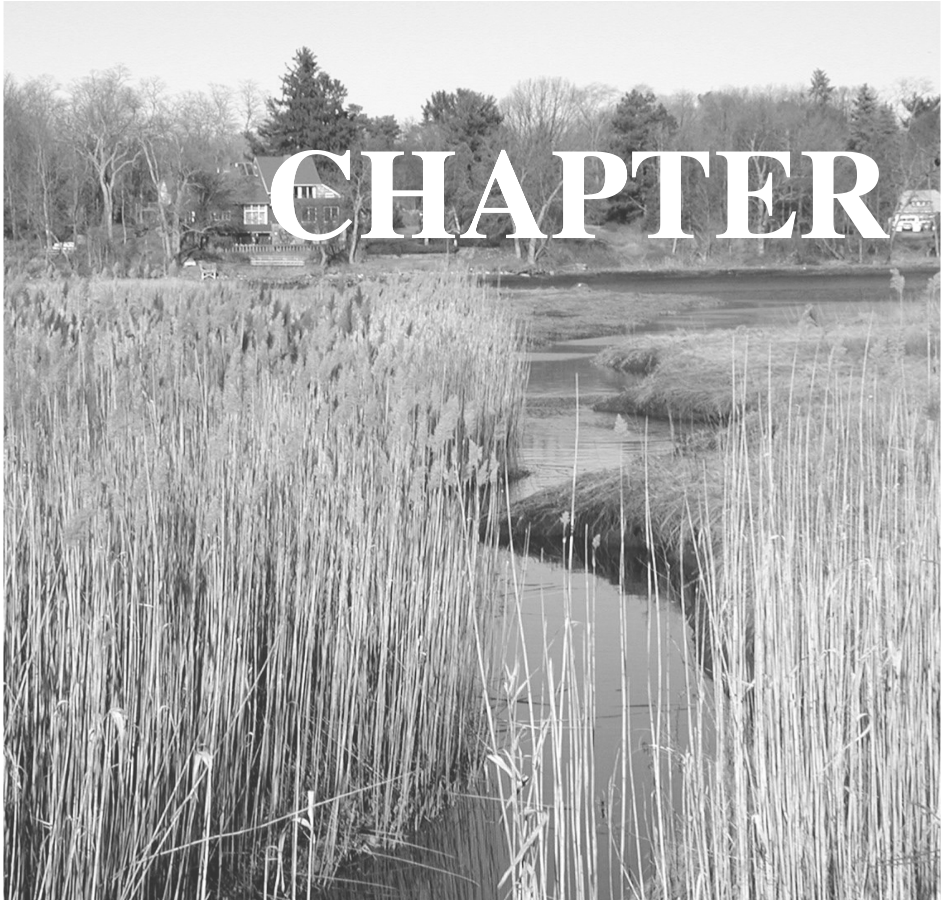


MAP 2-2
Water and Sewer Map



Map 2-3
Targeted Growth Map





CHAPTER 3

PHYSICAL AND ENVIRONMENTAL CONDITIONS

The Boston region consists of 101 cities and towns in Eastern Massachusetts encompassing approximately 1,405 square miles. The region roughly corresponds to a 20-mile radius around the City of Boston, with the communities traversed by I-495 as its western boundary. The region's expanding transportation system has opened up large tracts of land for residential, commercial, and industrial development. However, there are still many natural resources within the Boston region. Forests make up 39% of the area, with water, wetlands, and open space contributing another 11%. The region is bordered on the east by approximately 550 miles of coastal waterfront and the Boston Harbor Islands National Park. The Greater Boston area provides an urban setting rich in history and waterfront vistas. Inland, the region offers over 25 state forests and parks, as well as numerous freshwater rivers, lakes, and ponds.

LAND USE

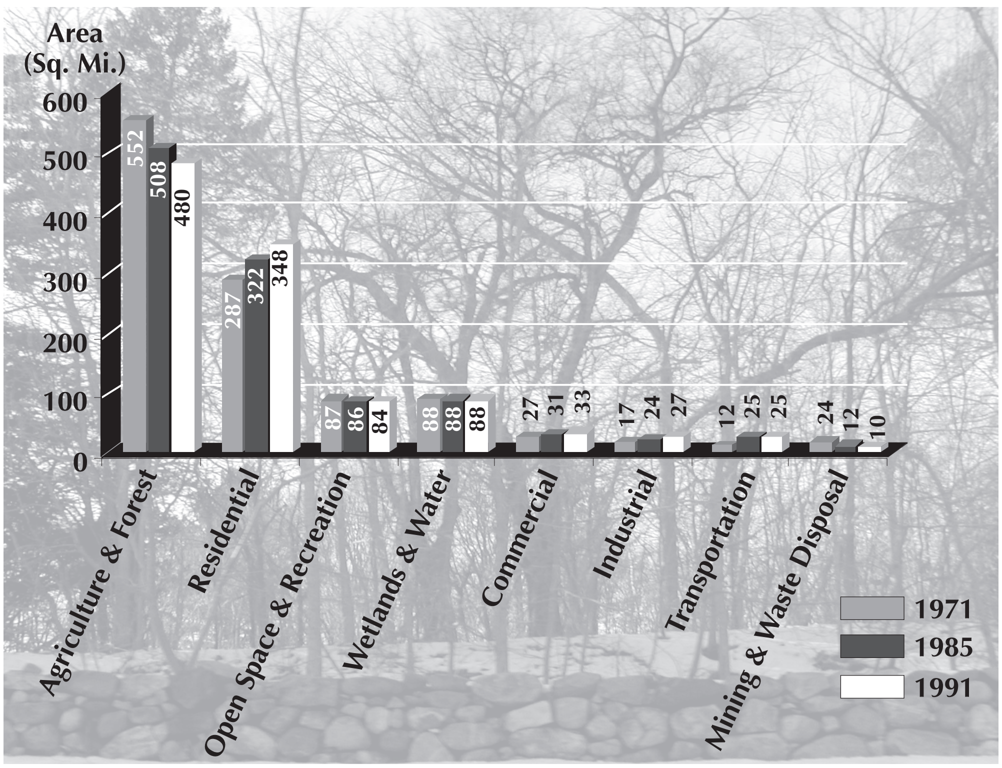
The City of Boston, commonly referred to as the "Hub of New England," has been the focus of the economy of the New England area during the last three centuries. Following World War II, changes in land use and development occurred throughout the Boston region. New zoning codes and the construction of new highways opened up large tracts of land for housing development. Thousands of families left the cities and moved to the suburbs. Later, jobs followed the people to the suburbs, and commercially zoned land was developed into commercial and industrial properties. Areas of commercial and industrial development are well established along the Route 128 corridor and are increasing along the I-495 corridor.

Since the 1970s, the region has seen an increase in square miles of residential development with a smaller increase in square miles of land being developed as commercial and industrial properties. As can be expected, this development is occurring on what was once agricultural and forested lands. Figure 3-1 shows the change in the number of square miles of the different land uses from 1971 to 1991 in the

Boston Region (data compiled by MAPC, based on MacConnell Land Use Analysis of 68 MAPC communities).

Agricultural, forested, recreational, and open space land decreased by approximately 72 square miles across the region from 1971 to 1991. The majority of this acreage has been developed as residential land (61 square miles) since 1971, with industrial (10 square miles) and commercial (6 square miles) development following. Most of this development is occurring in areas that were once forested.

FIGURE 3-1
Change in Land Use in the Boston Region
1971–1991



Another survey, conducted by the Massachusetts Greenspace Initiative (212 municipalities, including all 164 in the regional model, plus others to the south and west) showed a 15% increase in land development in the region between 1970 and 1990. During the same time period the population of the region grew by only approximately 5%. To visualize this another way, the land area developed between 1970 and 1990 was the equivalent of 4 and 1/3 cities the size of Boston, while the population increase during this same time period was the equivalent of roughly 1/2 the City of Boston.

The dispersed development pattern that has occurred in the region has resulted in a loss of productive farmland, forestland and wetlands critical to the region's environmental health, as well as the loss of community character of local municipalities; increased air pollution from vehicles due to longer commutes (where there is no mass transit alternative), increased infrastructure and municipal costs, and the decline and abandonment of previously developed industrial/commercial sites closer to the inner core.

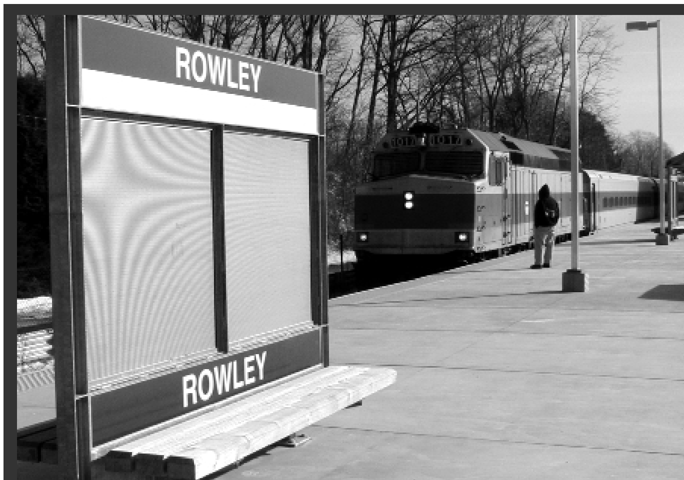
The Massachusetts Audubon Society's "Losing Ground" second edition, 1999, reiterates and expands on the information provided above. The Audubon Society study found that from 1972 to 1996, developed land in Massachusetts increased by 59%, while the population grew by only 6%. The rate of land consumption declined from the 1980's, but still remains at roughly 16,000 acres per year. "Losing Ground" reports that three of the five most rapidly growing areas of the state are in Eastern Massachusetts:

- The northern portion of Southeastern Massachusetts,
- The Winchester/Stoneham/North Reading area, and

- A broad band along the entire length of Interstate 495.

A review of the MAPC/MacConnell land use data on the community level confirms that the majority of the residential growth is occurring along the Route 3 and I-495 corridors. The largest change in residential acreage has occurred along the South Shore in the communities of Duxbury, Hanover, Marshfield, and Pembroke as well as the communities of Acton, Carlisle, Franklin, Marlborough, Medway, and Norfolk in the western part of the region. There has been little change in the urbanized area in and around Boston. However, this does not account for significant redevelopment in some areas already designated as developed by the MacConnell inventory.

The majority of land being developed for industrial and commercial purposes is located along the Route 128 and I-495 corridors. Industrial growth along the Route 128 corridor is occurring in the communities of Wilmington, Woburn, Burlington, Stoughton, Randolph, Canton, Braintree, and Quincy. Industrial growth along the I-495 corridor is occurring in the communities of Milford, Marlborough, Hudson, Franklin, and Bellingham. The communities of Cambridge, Everett, Needham, and Waltham have actually lost industrial acreage over the past 20 years. Commercial property has grown in the communities of Burlington, Danvers, Peabody, and Woburn, all located along the Route 128 corridor.



Rowley Commuter Rail Station on the Newburyport Extension

The trend since the 1950s has been development outside of the urbanized Boston area and in the suburbs. The transportation network has helped to guide the development patterns in the region. Development will continue to grow in the suburbs as long as the transportation system can handle the demand. Traffic on the interstate system continues to increase while the MBTA continues to expand its commuter rail system to also accommodate the demand. It is expected that the fastest growing communities in the Boston Region over the next twenty years will be those between Route 128 and I-495.

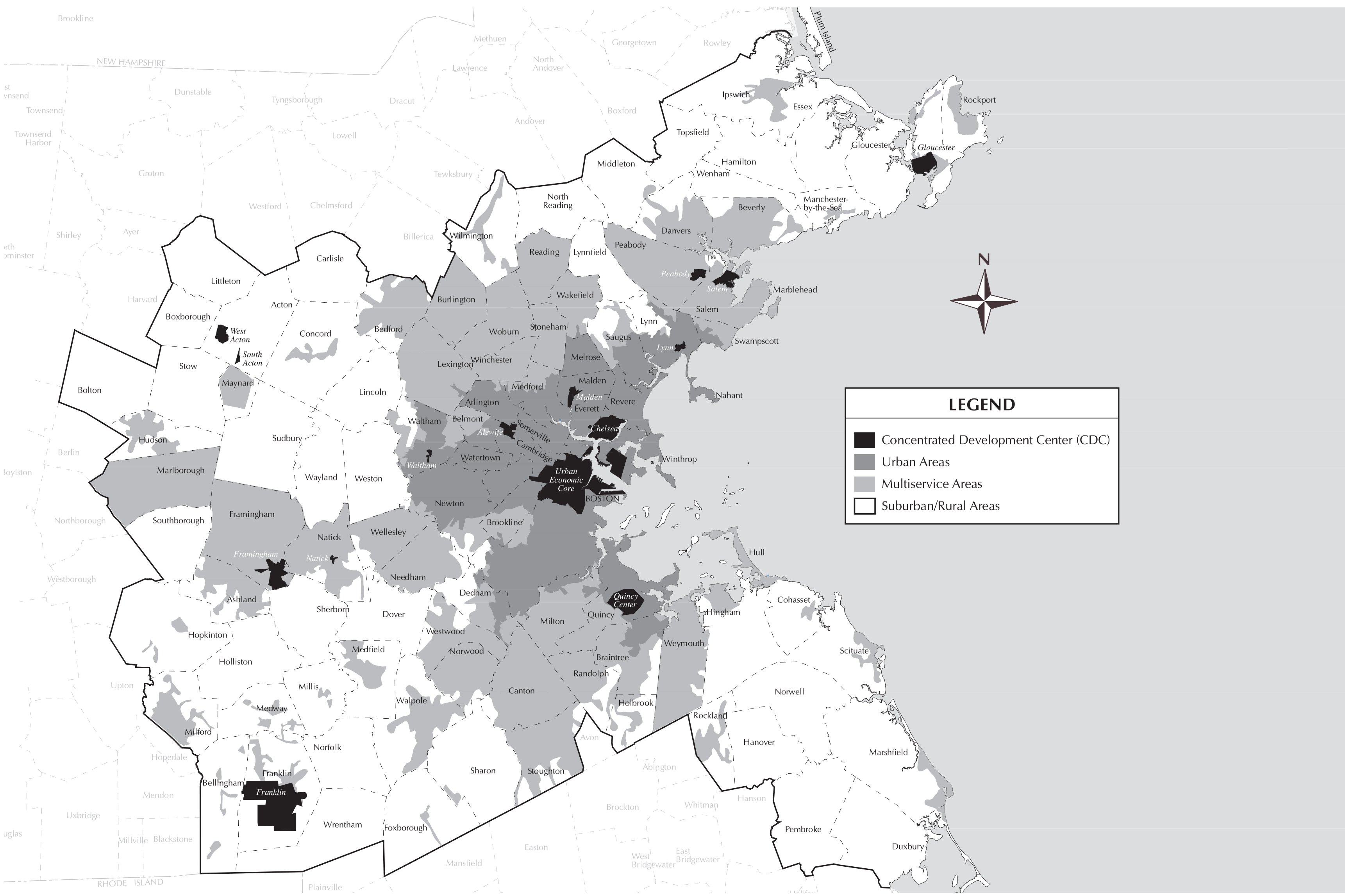
Planning for Growth

The transportation agencies have agreed to work with the state environmental, energy, and economic development agencies to advance a strategy which will encourage development to occur in areas well served by transportation facilities. An Executive Order on Planning for Growth was issued by the Governor in April 1996. It declared that the Commonwealth should actively promote sustainable development in the form of (a) economic activity and growth supported by adequate infrastructure without sacrificing environmental quality and resources, and (b) infrastructure development designed to minimize adverse environmental impacts from economic activity.

Under the Planning for Growth Program, the Executive Office of Environmental Affairs (EOEA) established a statewide program to fund a buildout analysis for all communities which began in June 2001. This program will provide each community with a vision of its likely future based upon existing local and state regulations and the physical constraints of the community. This will allow communities to determine if they have the natural resources and infrastructure capacity to handle projected growth.

The results to date illustrate that substantial undeveloped land remains available for development

Map 3-1
Concentrated Development Centers



in the "outer communities" of the Boston Region, while growth in the "inner" core communities will occur largely through redevelopment. Executive Order 418, signed by the Governor early in 2000, directs EOEA, the Department of Housing and Community Development and EOTC to provide funds to assist the communities in following up on the buildout analyses to plan for housing, open space, economic development and historic preservation.

The Community Preservation Act (CPA), signed into law in September 2000, is a local option. It enables communities to establish a municipal Community Preservation Fund by local referendum. Monies collected for this fund are from a surcharge of up to 3% on local property taxes. The state will offer matching grants from the Community Preservation Trust Fund. Monies in the Community Preservation Fund may only be spent on open space, historic preservation, and community housing. To date, 35 communities (16 in the Boston Region MPO) have passed this act.

MAPC's MetroPlan establishes guiding principles for development of the region. Implementation of MetroPlan's interlocal component is being partially implemented through meetings of the eight MAPC subregions. The subregions meet on a regular basis to discuss topics including water resources, transportation priorities and open space protection. MetroPlan's process will be rewritten and reexamined by MAPC in 2002 and 2003.

Concentrated Development Centers

Through the coordination of MAPC, Concentrated Development Centers (CDCs) have been designated throughout the region. CDCs are areas designated to encourage higher-density development where adequate public facilities, including transportation, sewer, water, parks, and recreation, are already available. CDCs were developed during the MetroPlan planning effort. Directing development to these areas may reduce vehicle travel and energy consumption, and encourage economic development. Map 3-1 shows the areas that are currently designated as CDCs in the Boston region.

Transit-oriented development (TOD) is a technique that can help achieve concentrated development. TOD consists of a high-density, mixed-use, pedestrian-oriented environment with easy access to a transit station. Specific goals of TOD programs are to create high-quality living and working environments, improve station access, implement local land-use plans, and increase tax revenue. TODs offer the possibility of enhancing transit ridership, attracting private investment, improving the quality of the environment, and providing new or expanded employment opportunities in inner-city transit areas. A number of ongoing or proposed TOD projects are being implemented including a redevelopment project within downtown Salem which is a conversion of an abandoned industrial site to offices, retail and housing adjacent to an intermodal rail facility.

Areas of Critical Environmental Concern

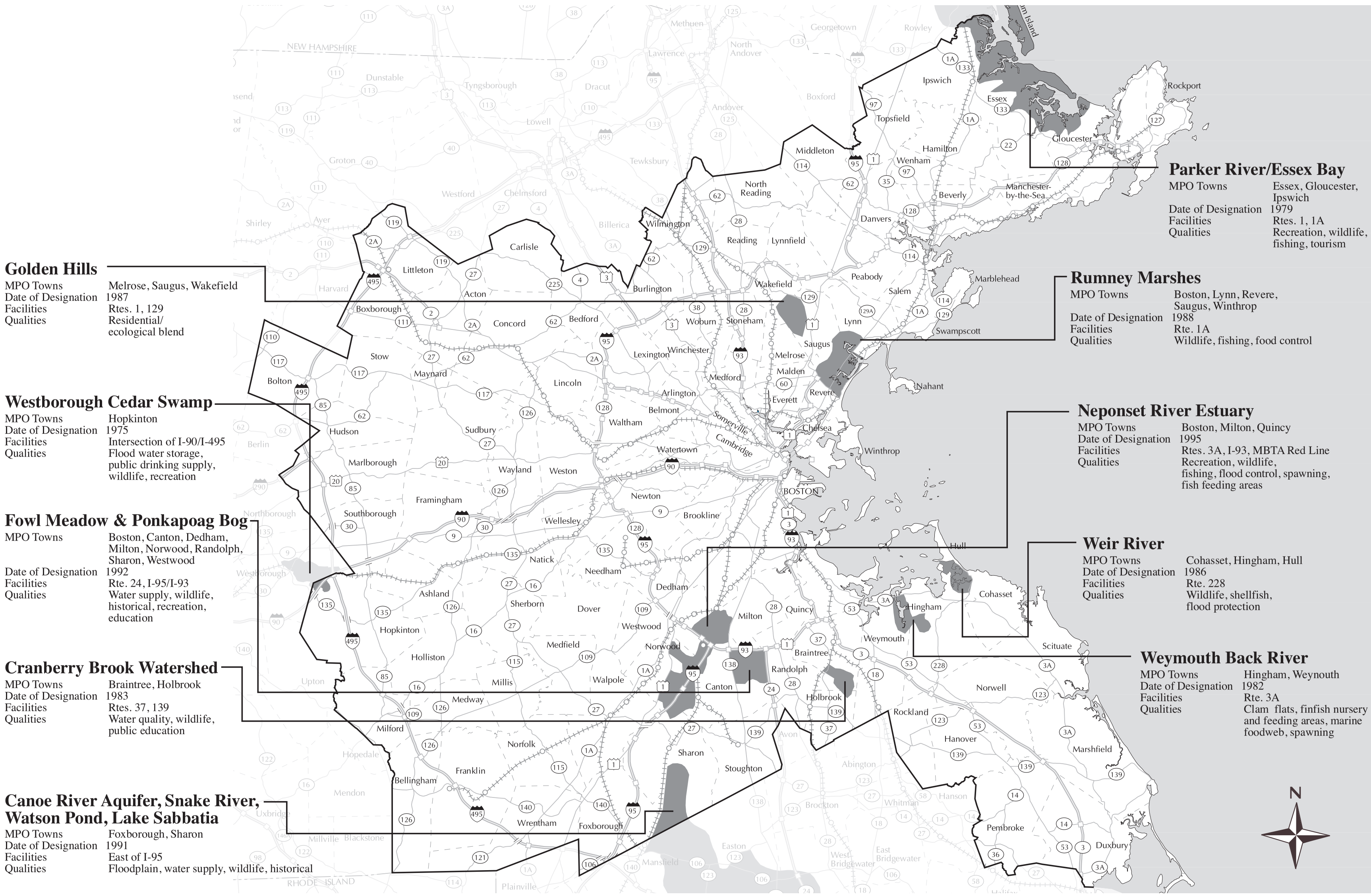
An Area of Critical Environmental Concern (ACEC) is an area containing concentrations of highly significant environmental resources that has been formally designated by the Commonwealth following a public nomination and review process. The Commonwealth established legislation in 1975 that authorized and directed the Secretary of the Executive Office of Environmental Affairs (EOEA) to identify ACECs and develop policies for their preservation and management. Any transportation project that is to be constructed in or around an ACEC must follow the regulations so that the project does not impact the ACEC. The ACECs in the Boston region are shown in Map 3-2.

Air Quality

Status of Air Quality in the Region

The Boston region has historically been classified as serious nonattainment for ozone. Ozone is formed when volatile organic compounds (VOC) and nitrogen oxides (NOx) mix in the presence of

Map 3-2
Areas of Critical Environmental Concern



sunlight. With this ozone nonattainment classification, the 1990 Clean Air Act Amendments (CAAA) required the Commonwealth to develop a State Implementation Plan (SIP) which outlined a strategy of programs to reduce VOCs, NOx and carbon monoxide (CO). In addition, the 10 communities of Boston, Cambridge, Chelsea, Everett, Malden, Medford, Quincy, Revere, Somerville and Waltham were classified as nonattainment for CO.

The Massachusetts Department of Environmental Protection (DEP) is the agency charged with developing the SIP. It has implemented a number of programs to reduce emissions from mobile sources and bring the Commonwealth's air quality into attainment. These programs include an Enhanced Automobile Inspection and Maintenance Program, a Low Emission Vehicle Program, and an Alternative-Fuels Program.

Inspection station

Existing Technological Mobile-Source-Emission-Reduction Programs in the Boston Region

Enhanced Automobile Inspection and Maintenance Program

The CAAA required the Commonwealth's original automobile emissions testing program to be upgraded to a new "high-tech" test. The Commonwealth began testing vehicles in October 1999 under this new program. The enhanced testing requires all automobiles, trucks, and buses to be inspected using an advanced computerized system called a dynamometer (a treadmill for cars) that simulates real-world driving conditions. In addition to emissions like hydrocarbons and CO, the enhanced test measures, for the first time, NOx. Emissions tests are now required every two years instead of every year, because the new test is more accurate than the program it replaced. Safety inspections are still required annually.

Low Emission Vehicle Program

DEP has established the Massachusetts Low Emission Vehicle (LEV) program. The LEV program promotes the use of cleaner vehicles to reduce emissions of air pollutants such as CO, VOCs and NOx. The program requires that all new passenger vehicles sold in Massachusetts meet a cleaner, California motor-vehicle-emission standard.

In December 1999, the Commonwealth promulgated LEV II, the next stage of the California LEV program. LEV II phases in more stringent emission standards for light- and medium-duty vehicles. It applies new exhaust, evaporative, and fleetwide average standards to all passenger vehicles and, for the first time, requires that most sport utility vehicles and light-duty trucks meet the same standards. Light-duty vehicles (under 6,000 pounds) must comply with the LEV II standards starting with model year 2004. The LEV II standards for medium-duty vehicles (6,000 to 14,000 pounds) take effect with model year 2003. LEV II also requires manufacturers to bring advanced vehicle technologies to the market. Starting in 2004, 10% of all vehicles available for sale in Massachusetts must be zero-emission vehicles (ZEV) or partial ZEVs.

Alternative-Fuels Program

Alternative fuels are an important component of the LEV program and the Energy Policy Act adopted by Congress in 1992. As outlined above, the LEV program requires vehicles to meet increasingly stringent emission standards in the

coming years. The Energy Policy Act sets guidelines for the acquisition of new light-duty vehicles for federal and state fleets requiring that certain percentages of new vehicles be alternatively fueled.

Automobile manufacturers are introducing alternative-fuel vehicles into their fleets in order to meet the more stringent emission standards and requirements being set by federal and state governments. Natural gas, electric, and, most recently, hybrid electric vehicles are emerging into the marketplace. Currently the Commonwealth's state-owned fleet includes 340 alternative-fuel vehicles. Of these vehicles, 147 are fueled by compressed natural gas, 93 are powered by electricity, 5 are fueled by propane, and 95 are ethanol/gasoline flexible-fuel vehicles. They are owned and operated by the following agencies.

- Massachusetts Port Authority – 61 vehicles
- Massachusetts Bay Transportation Authority (MBTA) – 21 vehicles
- Massachusetts Water Resources Authority (MWRA) – 15 vehicles
- Massachusetts Turnpike Authority – 6 vehicles
- Operational Services Division – 213 vehicles
- UMASS/Boston – 24 vehicles

The MBTA has explored different options for converting all or parts of its bus fleet to alternatively fueled buses. A pilot program tested two types of vehicles: diesel-electric hybrid and compressed natural gas. The MBTA reviewed data from this program on the operation of the vehicles and customer satisfaction and decided on compressed natural gas as being best suited for future MBTA service.

Fueling infrastructure for alternative-fuel vehicles is continuing to be built throughout the Commonwealth. Today, Massachusetts has 11 compressed natural gas refueling stations in operation that can be accessed by the public, and an additional 7 stations are planned to be built over the next two years. In addition, twelve electric charging stations are located in two MBTA parking locations (Braintree and Alewife) to support the electric vehicle demonstration program that is being conducted by the Massachusetts Division of Energy Resources. Construction of fueling infrastructure will be necessary to ensure the future success of the Alternative-Fuels Program.

In September 2000, the secretaries of the Executive Office of Transportation and Construction (EOTC) and the Executive Office of Environmental Affairs (EOEA) signed a consent order that mandates the completion of several transit projects within a set timeframe. The mandated projects cost a combined $2 billion and consist of studies, construction projects and vehicle procurements including the purchase of 358 alternative fuel buses by the MBTA.

Transportation Agencies' Contribution to Improved Air Quality in the Boston Region

Transportation Project Commitments in the State Implementation Plan

MassHighway has committed to funding projects throughout the Commonwealth that improve the flow of traffic and thereby reduce congestion and improve air quality. The following is a partial list of types of projects that have been implemented by local and state highway departments that improve traffic flow in the region:

- Intersection improvements, including channelization, signalization, and signal retimings
- Signal coordination at consecutive intersections
- Parking prohibitions
- Capacity increases through widening roadways or restriping existing pavement
- Curb cut consolidation

In addition as part of the approval of the Central Artery project, the Executive Office of Transportation and Construction (EOTC) committed to implementing specific transportation improve-

ment projects that contribute to improved air quality. These projects became part of the State Implementation Plan. The majority of these projects are being implemented by MassHighway and the MBTA. A partial listing includes:

- South Station Bus Terminal construction
- Newburyport Commuter Rail Extension
- Old Colony Commuter Rail Extension
- Framingham Commuter Rail Extension to Worcester
- 20,000 new park-and-ride spaces
- Interstate 93 Southbound HOV lane to Mystic Avenue
- Southeast Expressway HOV lane from Savin Hill to Route 3

Over 70% of the Central Artery-related transportation commitments have been completed. It is expected that most the remaining commitments will be in place by the Artery's completion in 2004.

The new programs have helped improve the air quality in the Boston region. In April 1996, the nine communities of Boston, Cambridge, Chelsea, Everett, Malden, Medford, Quincy, Revere, and Somerville were classified as attainment for CO; however, they remain in maintenance status for the next 20 years. This means that the Commonwealth must show that the communities continue to meet the CO standard over this period. Waltham, however, remains in nonattainment for CO.

In June of 1999, the United States Environmental Protection Agency (EPA) revoked the 1-hour standard for ozone in the Eastern Massachusetts ozone nonattainment area because monitoring of the air quality in this region showed that the 1-hour ozone standard had not been exceeded over the last three years. Currently, the Boston Region is in attainment for the 1-hour standard. EPA has, however, proposed that a new 8-hour standard replace the 1-hour standard. Once this standard becomes effective, the Boston Region will most likely be classified as nonattainment for the 8-hour standard based on past monitoring data. However, in October 1999, due to a recent court ruling on the 8-hour standard, EPA proposed to rescind the findings to revoke the 1-hour standard. This rescission became effective in Eastern Massachusetts on January 16, 2001. Therefore, this plan will determine ozone and CO conformity using the 1-hour standard.

Performance Measures for Transit Service Quality

A major goal for air quality improvement is to get people out of their single-occupant vehicles and into carpools, vanpools, public transportation, and bicycles. Important to encouraging that change in travel behavior is assuring that transit service performs at acceptable levels. In order to do this, the MBTA's Service Planning Department continues to evaluate improvements to the existing service and to provide service expansions.

The MBTA collects ridership data throughout the system, enabling it to identify excess capacity and other resources and direct them to the routes and locations at the times when they are most needed. One example of the effectiveness of this service planning effort is that, without an enlargement of the bus fleet, annual bus ridership on the MBTA increased from 92 million passengers in 1993 to 107 million in 2000.

Transportation Demand Management Programs

The Boston Region Metropolitan Planning Organization annually funds Transportation Demand Management (TDM) projects through the Congestion Mitigation and Air Quality Improvement (CMAQ) funding category of the Transportation Improvement Program (TIP). Funding is earmarked for projects, sponsored by public agencies, that will help the Commonwealth in improving its air quality. Specific TDM projects that have been funded in the TIP include shuttle services, park-and-ride lots, and bicycle projects. Transportation Management Associations (TMAs) are other recipients of MPO funding. TMAs are private, nonprofit groups formed to facilitate pri-

vate-sector involvement in addressing transportation issues. At present, of the twelve TMAs operating within the Commonwealth, nine are in the Boston Region MPO. These include the 128 Business Council, Artery Business Committee TMA, Charles River TMA, CommuteWorks/MASCO, Interinstitutional TMA at BU Medical Center, Logan TMA, MetroWest/ 495 TMA, Neponset Valley TMA, and the Seaport TMA.

High-Occupancy-Vehicle Programs

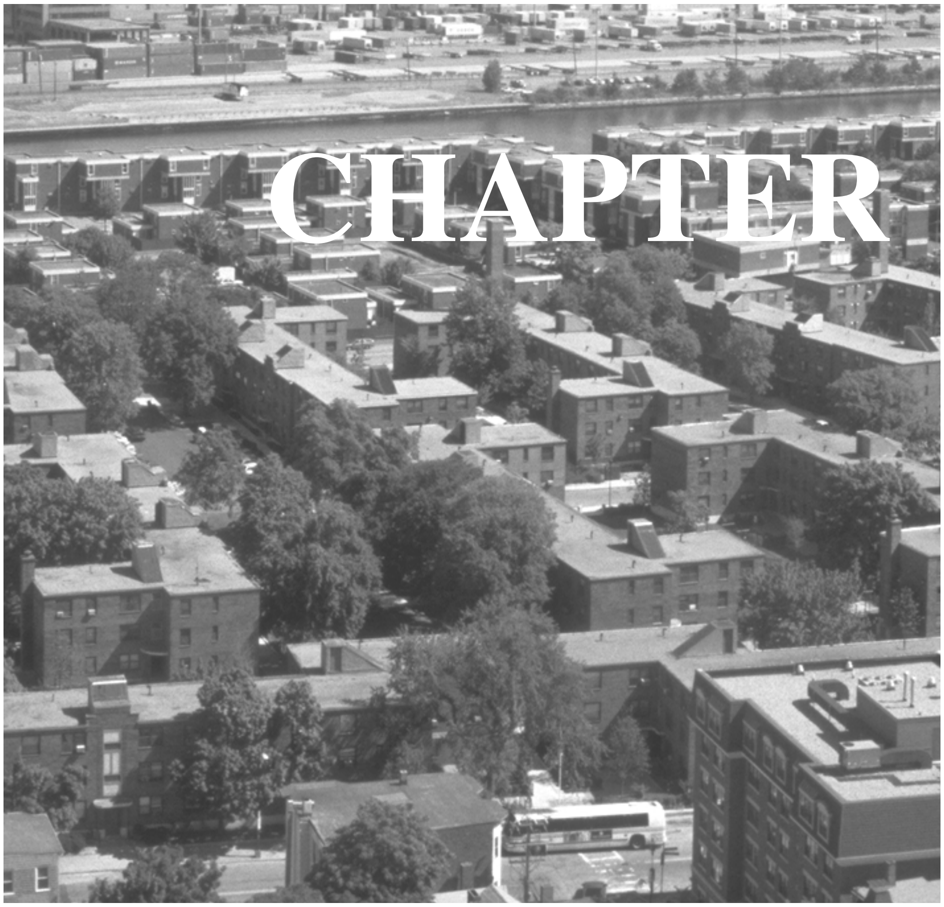
High-occupancy-vehicle (HOV) lanes are highway lanes dedicated to vehicles with two or more passengers. HOV lanes provide an incentive to form carpools or vanpools or take a bus, since these modes avoid congestion on general-purpose lanes and enjoy reduced travel time into the city during HOV lanes' hours of operation. MassHighway has constructed two HOV lanes on major highways leading into the City of Boston. One is on I-93 southbound from Mystic Avenue to the Central Artery. Vehicles in the lane are required to have at least two occupants between 6:00 a.m. and 10:00 a.m. on weekdays.

The other HOV lane runs for six miles, from Furnace Brook Parkway in Quincy to Freeport Street in Boston. Opened in November 1995, it is a contraflow lane that operates in the northbound direction during the morning peak period and in the southbound direction during the afternoon peak period. On weekdays, this lane is open only to vehicles with at least two persons between the hours of 6:00 a.m. and 10:00 a.m. northbound and 3:00 p.m. and 7:00 p.m. southbound. Both the I-93 and Southeast Expressway HOV lanes were constructed as mitigation measures for the Central Artery project.

Conclusion

Policy-makers at the local and state levels make decisions that impact both the built and natural environments. The connection between land use decisions and the environment has long been obvious. In recent decades policy-makers have begun to consider the connection between transportation investments and the effect they have on the environment and land use patterns.

The Boston Region MPO needs to take a leadership role in helping residents and policy makers better understand the transportation and land use connection, so that future investments do not contribute to further degradation of the environment. Despite the absence of full coordination between agencies or between state and local officials, the Boston region still possesses numerous and expansive natural treasures. In order to ensure that these are preserved without frustrating the economic viability of the region, the MPO and its agencies need to improve coordination with the Executive Office of Environmental Affairs, the Department of Environmental Protection, and the Executive Office of Community Development. Improved partnerships among state agencies should result in more efficient use of both land and transportation funding. The Commonwealth must also continue to strengthen cooperation with local officials through programs like Planning for Growth and Executive Order 418. Efforts should be made to build upon programs that provide incentives to both automobile owners and manufacturers to do their part to protect our region's air quality. And all stakeholders should be included in a discussion of the alternate land use scenarios developed by MAPC, as well as their implications, so that transportation policies are pursued that give the Boston region the best opportunity for maintaining and enhancing the quality of life for our residents.



CHAPTER 4

DEMOGRAPHICS OF THE REGION

This chapter looks at four main demographic statistics: population, households, employment, and automobile ownership. These four sets of statistics give a snapshot in time of how the region has developed and the mobility of its residents.

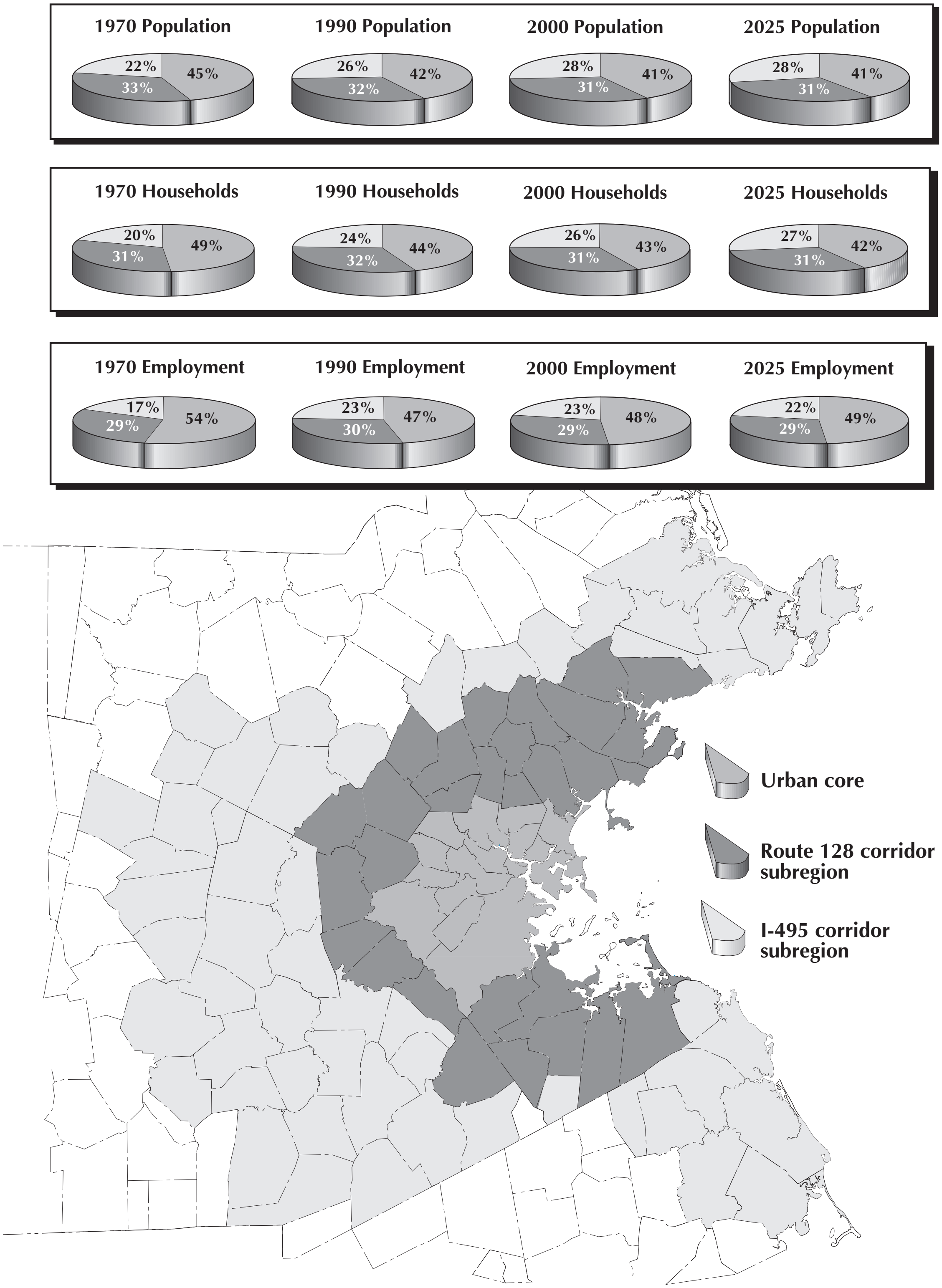
Unless otherwise noted, all references to the Boston region in this chapter are to the 101 cities and towns that make up the Boston Region Metropolitan Planning Organization. The map on the following page shows these communities. The map distinguishes between three demographic subareas used for analysis in this chapter:

- Urban core (14 cities and towns)
  Includes 14 cities and towns: Arlington, Belmont, Boston, Brookline, Cambridge, Chelsea, Everett, Malden, Medford, Newton, Revere, Somerville, Watertown and Winthrop.
- Route 128 subregion
  Extends from the edge of the urban core through the communities that border Route 128
- I-495 subregion
  Includes all the region's communities that are outside the Route 128 subregion

Much of the data used for this chapter is derived from U.S. census data. The last census took place in 2000 and some of this information has been incorporated into this chapter. However, some of the statistics used here may be dated since all of the 2000 census information is not yet available. Chapter 11, Forecast of 1995 Base Case and 2025 Build Scenarios, uses 1995 estimates and 2020 projections for population, employment, and households for the region to project future conditions for the region.

It should be noted that much has changed in the region during the decade since the 1990 U.S. Census. The decade began with the economy in a regional and nationwide recession during 1990 and most of 1991. Since that time, the nation has been experiencing the longest period of economic prosperity in the

FIGURE 4-1
Demographic Shifts in the Boston Region



past 100 years. However, what has not changed over the last decade are the trends for the region that started in the 1950s. These include a continuation of migration of population and jobs to the suburbs and a dispersion of trips by residents.

Relationship of Transportation and Land Use

Transportation and land use have a symbiotic relationship. A new transportation infrastructure development, such as a new interstate or commuter rail line, can cause a rural area to transform into a suburban area with increases in housing and employment. Likewise, an increase in population or employment in a sparsely settled area can impose demands on the transportation network that require new infrastructure to be built. The prospect of cheaper land often may be a determining factor in locating a new suburban office park or industrial center. This in turn imposes demands on the transportation system to improve access to new development.

The development of the interstate highway system beginning in the 1950s greatly increased the mobility of the American population and opened vast areas of the country to new development. Zoning regulations and cheaper land for housing and employment centers led to the development of suburbs north, west, and south of the traditional urban core of the Boston region. This led to a dispersion of jobs and housing from the urban core to suburban and rural areas.

One of the main problems with this dispersion is the difficulty in efficiently serving the transportation needs of all of the people of the region. In order for transit to succeed, it requires a concentration of households and a concentration of destinations, whether they be work, shopping, or schools. Dispersed development patterns cost more for roadway construction, increase driving costs, create additional air pollution and result in a conversion of open space to developed land. As this concentration of people and destinations disperses, the ability to serve people decreases.

The use and increased availability of the automobile has increased mobility and local suburban zoning ordinances have encouraged less dense concentrations of people and employment. The population living in the traditional inner core shrank from 60% in 1950 to 42% in 1990. There has been a steady migration of people out of the urban core and into first the Route 128 region and then to the I-495 region. The growth of population in the past decade has been especially pronounced to the west and northwest of the urban core.

As these low-density development patterns have been replicated by newer suburbs in the I-495 region, a significant amount of housing has been constructed beyond the MPO's boundary. Constraints on municipal water and sewer systems are other factors that have driven growth beyond I-495. Many towns that lie outside of the Massachusetts Water Resources Authority's service area face real limits that will prevent them from growing at current rates for more than a couple of decades. As zoning or infrastructure constraints continue to push residential growth beyond the I-495 corridor there becomes less that MPO agencies can do to efficiently move residents between home, jobs, and shopping, not only in the traditional urban core, but also to employment centers along Route 128.

From the standpoint of cities in the core these constraints on growth in the suburbs may prove to be a blessing. In past decades there has already been a significant reversal in many of the trends that had typified the decline of older urban areas. Homebuyers frustrated by the time necessary for suburban work commutes, and the lack of modal choice in making those commutes, have begun to invest in older urban communities. The population of the city of Boston increased for the second time since World War II when the 2000 census showed an increase from 574,283 in 1990 to 589,141. Boston neighborhoods from Charlestown to Roxbury have seen significant portions of their housing stock renovated by new residents attracted in part by the easy access via transit or walking to employment and shopping. In the case of urban neighborhoods where major

transit investments have been made, such as East Arlington, West Somerville and North Cambridge along the 1980's extension of the Red Line, the infusion of investments by business and home owners has been nothing short of dramatic. And as the alternative increasingly becomes housing in ever-distant suburbs with few if any transit options, Boston and other urban core communities should continue to be able to build on the opportunities that their transportation infrastructure and density provide. Although the population continues to disperse, the center of the metropolitan area is no longer being abandoned.

Population

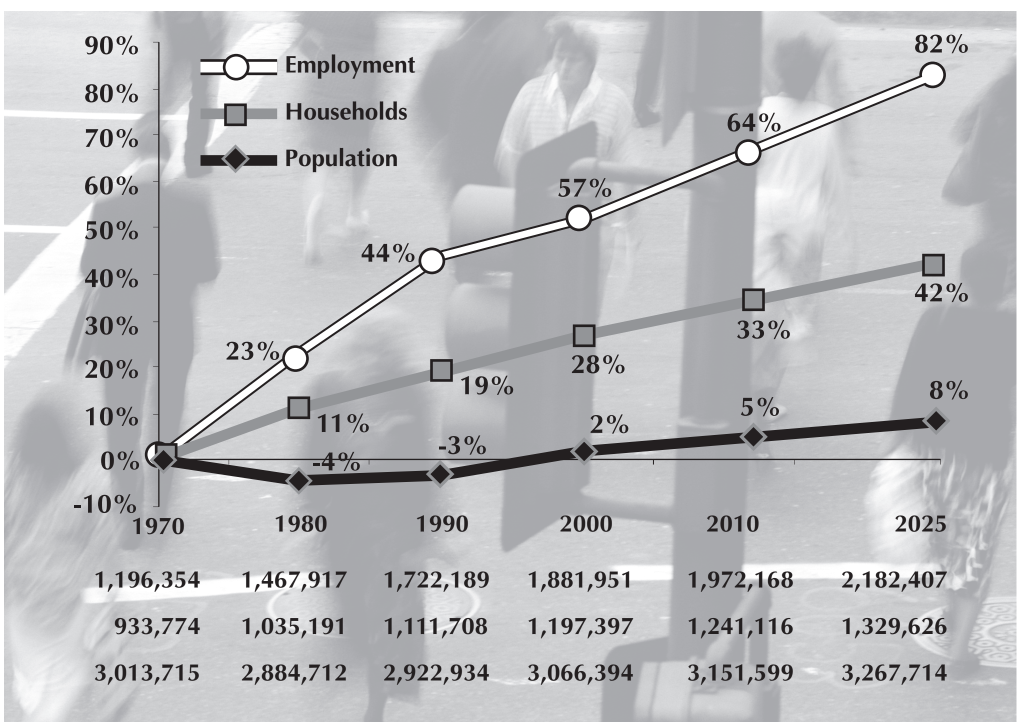
The population of the Boston region has remained fairly constant for the past four decades. According to the U.S. Census, from 1970 to 1990 the population of the Boston region decreased by 3%, from 3.01 million to 2.92 million. Mid-decade estimates (1995) of population for the region show it returning to the 3 million level. This is during a time when the United States as a whole is growing. The U.S. population grew by 12.6% from 1992 to 2000.

What has not remained constant is where the residents live within the region. There has been a dramatic shift in population from the urban core to the suburbs. In 1950, the population of the city of Boston was 801,000. In 2000, the population of the city of Boston was 589,141, a decline of almost 27%. This phenomenon of movement of people and employment out of the urban core and to the suburbs has created a pattern of development dubbed "suburban sprawl" that has been repeated across all areas of the United States.

In 1950, most of the population of the region lived in Boston, the cities adjacent to Boston, or communities along the Massachusetts Bay coast. This was before the time of the interstate highway network. Route 128 was not yet built, and the fastest way to travel into Boston from the suburbs was by commuter rail. The decade of the 1950s saw the construction and completion of Route 128, the Massachusetts Turnpike, the Central Artery, the extension of Route 3 North and South, and Route 24.

By 1960, the populations of Boston, Cambridge, Somerville, Revere and Medford had experienced declines in population from 1950 levels, while virtually every community along the newly opened Route 128 and Route 3 North had growth in population. The improved access provided by new highways made life in the suburbs more desirable for those who could afford the move. The cost of land and housing in the suburbs was

FIGURE 4-2
Changes in Demographics in the Boston Region



cheaper than that of comparable housing in the urban core.

Between 1960 and 1970, population continued its migration away from the urban core. The communities experiencing the fastest growth in population were no longer those along Route 128, but further away from the urban core. By this time, Route 3 South had been extended, I-93 North had been constructed, and parts of I-495 were under construction. The ring of communities outside of Route 128 were undergoing the transformation from rural to suburban communities.

By 1980, the outer suburban areas continued growing, while almost all communities within Route 128 experienced a loss in population. The residents of the region were moving to communities along the I-495 belt. The areas with the greatest growth included the communities along Route 3 in the South Shore.

By 1990, the City of Boston had actually gained population over the past decade as people started to migrate back to the urban centers. But this shift was small in comparison to the out-migration of the previous four decades. Although some growth occurred in cities located in or near the core, the largest gains were experienced in communities to the south along I-495.

It should be remembered that all of this change in where people lived within the region occurred while the population as a whole remained relatively stable. Unlike other areas of the country like the South and the West that have been experiencing population increases, Boston and New England have not grown in population over the past several decades.

Although MAPC Basic Forecasts projections show the MPO region as a whole growing by 7% over the next 25 years, there would be little change in the distribution of this population. While the I-495 towns are expected to account for 28% of the population in 2025 (as opposed to 26% in 2000), the urban core would still be the home of 41% of MPO residents, and the Route 128 region would have 31% of the population. When the remainder of the Eastern Massachusetts model area is included, the MPO's share of the population declines slightly from 71% to 68%. The population of Eastern Massachusetts cities and towns outside of the MPO region is expected to increase 20% by 2025 over current levels. This shift does not include all of the suburbanization that will occur. Even greater proportional population growth than what is being projected for the Eastern Massachusetts model is occurring in southern New Hampshire, central Massachusetts, Cape Cod and the south coast of Massachusetts. What does seem clear is that the 50-year trend of population loss in the urban core has slowed, and that the next 25 years should see a stabilization of the population.

HOUSEHOLDS

The second major change in demographics in the region is the change in the number of households. While the population has remained stable, a dramatic change since 1970 has been the increase in the number of households within the region, an increase of 19% over the two-decade period from 1970 to 1990. The chart of Changes in Demographics in the Boston Region, Figure 4-2, shows the percentage increase from 1970 for employment, households and population. The average number of people per household fell from 3.2 people per household in 1970 to 2.6 people per household in 1990.

There have been several reasons for this trend. One is that an ever-growing number of people have the economic ability to purchase a home and live apart from a larger family unit. Nationally, home ownership is at an historic high, with approximately 67% of all households owning their own home. It should be noted that the home-ownership figure is not as high in the Boston region because of the higher than average cost of living. According to the U.S. Department of Housing and Urban Development, this increase in home ownership has occurred across all income categories.

Another reason for the increase in number of households is that they are no longer as likely to be composed of a “traditional household” of two

parents and children. Single-parent households are increasing, as are the number of people living alone. Also, households are not as likely to be composed of more than two generations as they were in the past.

The increased mobility afforded by automobile ownership has allowed people to move farther from work and shopping destinations. Homes and apartments in the less developed or rural areas are usually less expensive and more affordable to more people who otherwise would not have the option of living apart from a larger family unit.

As fewer people live in a household, the demands placed on the transportation system increase. With fewer non-working spouses at home, more automobile trips tend to occur during peak commuting periods. Tasks such as grocery shopping and other errands tend to occur in conjunction with work trips rather than during off-peak hours.

MAPC projections for number of households located in MPO municipalities tell a similar story as the one told through the population projections. The MPO region as a whole experiences an increase of 12% in the total number of households. This outpaces the growth in population described above, and therefore reflects a continuation of the trend toward smaller households. Very small increases in the proportion of households (2%) located in the I-495 region are observed while losses in proportional number of households for the urban core and Route 128 regions are minimal (1%). Again, the number of households located within the model area but outside of the MPO increases slightly, from 28% to 30%.

EMPLOYMENT

While the population has remained constant, the number of jobs within the region has grown dramatically. The Boston region saw a 44% increase in the number of jobs from 1970 to 1990, while experiencing no increase in population. This trend of job creation continued during the economic expansion of the 1990's.

This increase in employment without an accompanying increase in population has been achieved in several ways, each of which places a greater burden on the transportation network.

- The percentage of residents living within the region who work has increased as more women and teenagers have joined the workforce.
- The number of people holding more than one job has increased.
- The number of people commuting from outside the region who work within the region has increased.

All three of these factors place stress on the transportation network during peak travel hours, when the system has the least amount of capacity available to handle the increased demand.

As shown in Figure 4-1, Demographic Shifts for the Boston Region, the percentage of the region's jobs that are located in the urban core has dropped from 54% in 1970 to 47% in 1990. As with population, the shift has been to the outer suburbs. This dispersion of jobs also makes it more difficult to provide transit service for the commuting trips.

Projections out to the year 2025 show MPO job growth at 17%, outpacing both population and household growth. Since the region is currently experiencing very low unemployment, and the majority of women are already in the workforce, this increase in jobs will have to be absorbed by residents from outside the MPO. At the same time, non-MPO Eastern Massachusetts job growth is also projected to grow at 21%. This is comparable to the increase in population projected for those areas, so the increase in MPO jobs will have to be met, in part, by workers commuting from beyond the model area. This further increases the demands on the suburban transportation network to move people efficiently throughout the region.

AUTOMOBILE OWNERSHIP

Automobile ownership has been rising in the region, even in cities like Boston and Cambridge where transit connections are good and walking

distances are short. Of the approximately 1.1 million households in the Boston region, 83% own at least one automobile, according to the 1990 U.S. Census. Ownership of an automobile had become a pervasive fact in the 1990s. Of the other 17%, the vast majority are in the communities of Boston, Cambridge, Brookline, Chelsea, Everett, Somerville, Revere, Lynn and Malden in the traditional urban core. All of these communities have a relatively high level of transit service. As one travels outward from the core, the proportion of households without an automobile decreases.

This widespread ownership of automobiles and high number of households with multiple automobiles are factors in how people determine how to travel. Another factor is the presence or absence of adequate transit service. Regionwide, 45% of all households have at least two automobiles and 12% have three or more.

Conclusion

This chapter has attempted to provide a brief overview of the demographics issues facing the region. While the urban core has seen a renaissance of people moving back into the cities over the past decade, the dispersion of people and jobs within the region has continued.

The trends in the four areas this chapter deals with (population, households, employment and automobile ownership) have made it more difficult for the MPO to provide an efficient transportation network to the region's citizens. Instead of a traditional commuting pattern of radial travel to the jobs in the urban core as existed in the 1950s, the region is faced with an ever-increasing pattern of commuting from suburb to suburb.

For a time, the dispersion of people and employment to the suburbs gave relief to urban congestion as people shifted away from a traditional radial commute into the urban core to one of suburban travel. But now that the excess capacity of the highways serving suburb-to-suburb travel is being reduced, the problem of congestion facing the suburbs is growing.

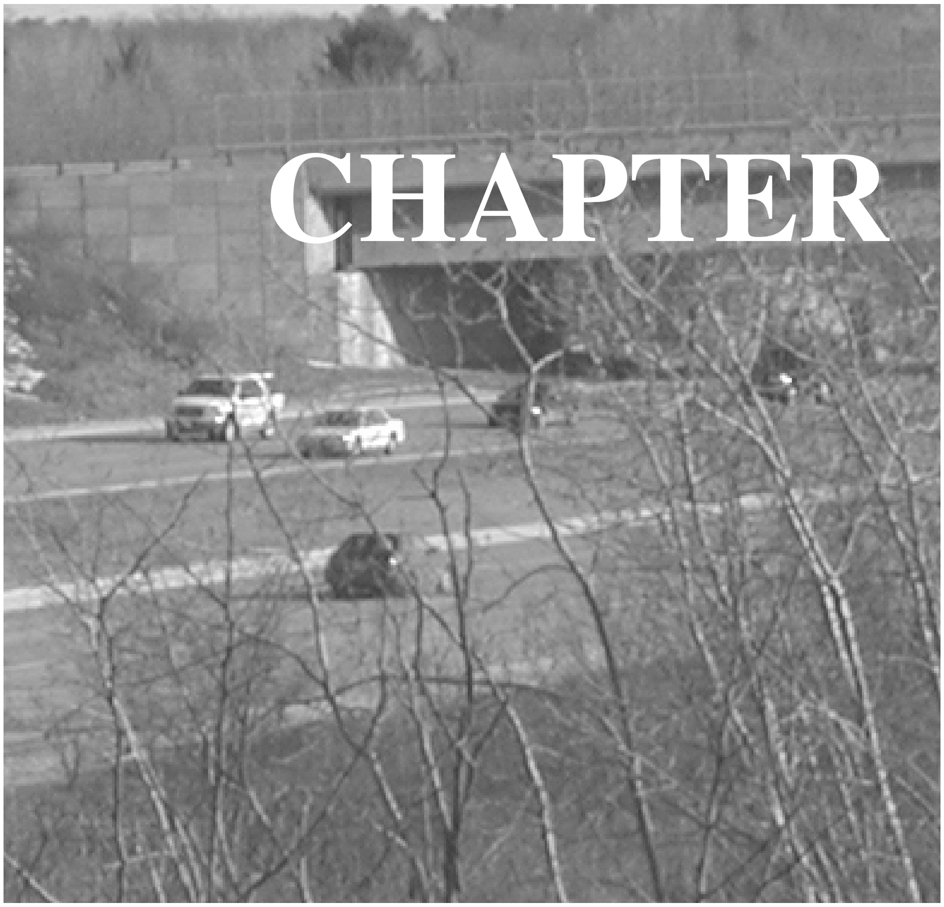
This dispersion of people and jobs also makes it more difficult to use any form of travel other than single occupancy vehicles (SOV). Providing alternative travel options to SOV is more challenging because it becomes harder to find others with the same origin and destination as well as the same travel schedule. The dispersion of people and jobs requires additional costs for all transportation modes. And although population levels across the different regions of the MPO appear to be stabilizing in relation to one another, the increase in commuters from beyond the MPO means that these additional transportation costs will continue to be borne by the MPO agencies and the citizens of the Commonwealth.

But while the Boston Region MPO faces many of the same challenges in providing transportation options to a diffuse population that other metropolitan areas do, Boston has many strengths to build upon. As one of the oldest metropolitan areas in the country, and one that was mature before the dominance of the automobile, the Boston region has advantages over newer metropolitan areas in the South and West. The vast majority of the development in these newer cities occurred after the popularity of the automobile was well established. The resulting low-density development makes it difficult for them to employ transit as a solution for even traditional suburb-to-downtown commutes. In the Boston region there is a sizable urban core that already supports one of the nation's largest transit system.

The suburbs of Boston are also much different from their "centerless" counterparts in newer metropolitan areas. In the Boston Region MPO, suburbs are typically anchored by a traditional New England village center. The existence of centers that are often accompanied by a transit station in even our suburban regions provides an opportunity for increased density in specific areas throughout the region. The MPO region's age does not make it better suited to deal with the transportation problems faced by many residents in its outlying regions. However, by reinvesting in its historic population and employment core, the MPO can manage transportation challenges by

providing its residents and employers with a variety of mobility options.

For a more in-depth discussion of the demographics of housing, employment and its connection with commuting within the Boston region, the reader should refer to *The Demographics of Commuting in Greater Boston,* (CTPS, August 1998). This document has served as a basis for much of the discussion in this chapter. It explains the pattern of commuting seen in the Boston region by looking at demographic trends since 1950. A copy of the document may be obtained by contacting CTPS at 617-973-7100, by faxing a request to 617-973-8855, by downloading from the CTPS web site at www.ctps.org/bostonmpo or by e-mail to publicinformation@ctps.org.



CHAPTER 5

ROADWAY SYSTEM

The region's roadway system is comprised of freeways, expressways, arterials, collector roads, local roads, and bridges. The regional roadway system consists of approximately 23,024 lane miles. Lane mileage within the 101 communities of the MPO region ranges from 41 miles in the Town of Nahant to 2,493 miles in the City of Boston. Funding for roadway improvements (both rehabilitation and new construction) is provided from federal and state resources. Massachusetts annually receives approximately $510 million per year in federal highway funds, 71% of which is currently allocated by the state and MPO to the Central Artery project and 29% of which is used for the statewide road and bridge program. In addition, the state annually provides funding to match federal-aid, to fund non-federal aid projects, and to address local transportation needs. The legislature generally allocates approximately $100 million annually in Chapter 90 funds. Chapter 90 money is used by communities to address local transportation needs, subject to criteria established by the legislature and implemented by MassHighway.

Roadway Characteristics and Pavement Management

Regionwide, there are 6,726 miles of arterials, including 1,138 miles of interstate; 2,816 miles of collector roads; and 13,932 miles of local roads. Table 5-1 shows the ownership of the lane miles within the Boston Region MPO. It is important to note that the classification of a roadway does not necessarily correlate to ownership of the roadway.

Roads and streets are grouped into functional systems according to the types of service they provide.

Table 5-1
Ownership of the Regional Highway System (Lane Miles)

Massachusetts Highway Department	2,494
Metropolitan District Commission	463
Massachusetts Turnpike Authority	202
Massachusetts Port Authority	16
Other State Entities	31
City/Town Accepted	17,909
Federal Agencies	10
Unaccepted (Private)	1,899
TOTAL	23,024

As defined by the Federal Highway Administration (FHWA), freeways, expressways, and arterials provide a high level of mobility at a relatively fast speed for long uninterrupted distances and are not intended to provide access to specific locations. Arterials in the region include all of the interstate highways as well as heavily traveled numbered routes. Examples include Route 2, Route 9, Routes 1 and 1A, and Route 3.

Collector roads provide a lower level of mobility than arterials at lower speeds and for a shorter distance. Collectors connect local roads with arterials and provide access to abutting land uses. Local roads provide a high level of access to abutting land but limited mobility and Figure 5-1 shows a breakdown of roadway ownership, classification, and type.

FIGURE 5-1
Breakdown of Roadway Ownership, Classification and Type

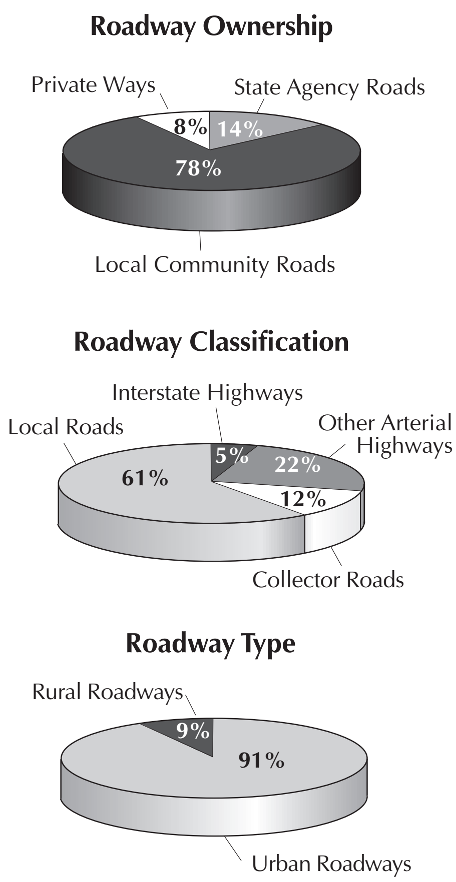
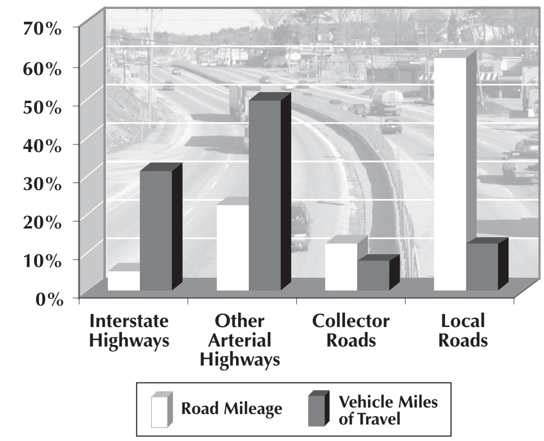


FIGURE 5-2
Roadway Classification and VMT



Over time the nature of a road can change as the nature and character of a community evolves. For example, Route 9 which was constructed as an arterial route connecting the western part of the state to the urban core now also serves a more local function as it traverses community centers and provides access to extensive commercial development. Changes in roadway characteristics often result in operational adjustments: speed limits may be reduced, intersections may be signalized, and access points may be increased. Nevertheless, the underlying purpose and resulting classification of the roadway does not typically change. While segments of Route 9 may serve a more local purpose, it still remains an arterial highway which provides an important link between regions of the commonwealth.

In response to the evolving characteristics of, and community concerns about, some of the state's roadways and their impacts on the communities through which they traverse, MassHighway has formed a task force to examine how highway projects impact historic and rural areas. The goal of the task force is not to produce new design standards for historic and rural areas, but rather to improve the way in which MassHighway designs, constructs, and reviews projects in these sensitive areas. It is useful to note that MassHighway does have a procedure in place that allows for consideration of design waivers. Communities that would like design waivers are urged to submit requests as early in the design process as possi-

ble. This allows public support to be assessed at, or prior to, the submittal of 25% plans and also can help to contain project costs.

The daily vehicle miles traveled (VMT) by all forms of motor vehicles in the MPO region in 1995 was approximately 62.5 million miles. The vast majority of this travel, approximately 50.2 million miles, occurred on arterial highways, while 4.7 million miles occurred on collector roads and 7.5 million occurred on local roads. Figure 5-2 shows a comparison of regional roadways by classification with the percent of vehicle miles of travel that type of roadway handles. As shown in the figure, arterials carry the majority of daily traffic, while comprising less than 25% of the roadway mileage.

Veteran's Memorial Bridge

The Massachusetts Highway Department maintains a pavement management system that rates the pavement quality on the Interstate Highway System. Under this system, a pavement serviceability index (PSI) is calculated for each interstate segment encompassing both road roughness and pavement distress. The PSI of a roadway decreases over time due primarily to repeated load applications and environmental factors. A roadway segment with a PSI of 2.5 or less is a candidate for immediate improvement, while those with a PSI of between 2.5 and 3.0 should be considered for rehabilitation in the short term. As of 1998, approximately 5% of the interstate system statewide was in need of immediate attention, while 14% was projected to need rehabilitation in the near future. In the MPO region, approximately 51 centerline miles of interstate have been identified as candidates for rehabilitation, with approximately 8 miles being rated in poor condition and 43 miles in fair condition.

Bridges in the MPO Region

There are 1,516 roadway bridges in the MPO region. The average age of the region's bridges is 39.5 years, while the median date of construction is 1963. The Massachusetts Highway Department maintains a statewide bridge management system. As part of this system, each bridge in the state is periodically inspected and the results of the inspection are tabulated in the Statewide Bridge Inventory.

The bridge inventory rates bridges according to national standards developed by the American Association of State Transportation and Highway Officials (AASHTO). Under the AASHTO standards, bridges are assigned to one of three classifications: meets standards, is functionally obsolete, or is structurally deficient.

A bridge is rated as functionally obsolete if it fails to meet current traffic demands and/or highway design standards. Evaluation criteria include

Table 5-2
Classification of Bridges by Owner

Owner	Total	Meeting Standards	Functionally Obsolete	Structurally Deficient
MassHighway	940	537	295	108
City/Town	255	133	75	47
MassPike	135	84	43	8
MDC	104	45	43	16
MBTA	69	25	28	16
Other State	13	2	11	0
TOTAL	1,516	826	495	195

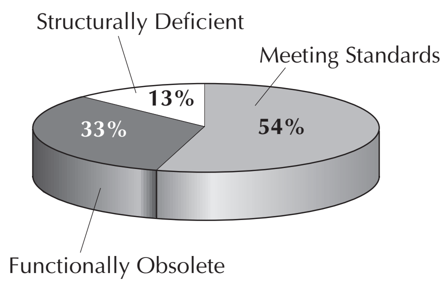
Map 5-1
Roadway Mobility Problems by Source of Identification

bridge width, traffic volume and characteristics, and roadway condition. Functional obsolescence is not necessarily caused by a deficiency in the bridge itself, nor is it an immediate safety concern.

A bridge is rated as structurally deficient if it has undergone deterioration significant enough to potentially reduce its load-carrying capacity. Structural deficiency is an indication that reconstruction of the bridge is, or can be expected to be, necessary in the near term.

Table 5-2 shows the AASHTO classification of bridges in the MPO region by ownership and Figure 5-3 shows the overall percentage of bridges within the region assigned to the three AASHTO classifications.

FIGURE 5-3
Classification of Bridges



CONGESTION MANAGEMENT

The MPO maintains a Congestion Management System (CMS) to identify areas with mobility problems and examine alternative solutions to addressing those problems. The impetus for developing and operating a CMS began in 1991 with the federal Intermodal Surface Transportation Efficiency Act (ISTEA). ISTEA required state departments of transportation and metropolitan planning organizations to implement a CMS. ISTEA's successor, the Transportation Equity Act for the 21st Century (TEA-21), adopted in 1998, continues the requirement. CMS findings must be considered in the development of a region's Transportation Plan and its Transportation Improvement Program (TIP). Moreover, for air-quality non-attainment areas such as the Boston region, any expansion of roadway capacity must be developed in the context of the CMS. Currently, the Boston region is not in attainment for ozone.

The CMS for the Boston Region Metropolitan Planning Organization (MPO) is designed to locate mobility problems and demonstrate alternative improvements that can be used by decision makers for project planning, priority setting, and programming. The CMS is a two-part sequential process that consists of the periodic CMS report and CMS planning studies. The purpose of the planning studies is to test and recommend improvements that can eventually be incorporated into the Transportation Improvement Program (TIP).

Problems of mobility are identified by three sources: the CMS monitoring program; planning studies; and community comments. The CMS monitoring program identifies problems using performance measures and thresholds of acceptable service. The program is highly systematic in that it covers many facilities and filters out only the most problematic locations.

Planning studies are usually undertaken after some general knowledge of a problem exists. The studies are geared towards exploring problem causes and identifying improvement alternatives. The following list identifies significant planning studies currently underway or completed for the MPO. Studies often constitute the first phase of a project's development, and as such, serve as an indication that the MPO is not only aware of but also is actively investigating a problem.

Accident Warrants - 3 Sudbury Intersections

Assabet River Bikeway Feasibility Study

Bike-to-the-Sea

Bus Route 66/Arterial Signal Retiming Study

Central Corridor Bus Service Study

Central Mass Commuter Rail Feasibility Study

Central Mass Rail Trail Feasibility Study

CMS Field Reconnaissance and Monitoring on Arterials

Commuter Rail Service to Bourne

Commuter Rail Service to I-290 in Northborough

Commuter Rail Service to Milford

Commuter Rail Service to Millis

Congested Signalized Intersections Study - 4 Intersections

Congested Signalized Intersections Study - 5 Intersections

Evaluation of the FHWA Bicycle Compatibility Index Using MetroWest Roadways

Hull Circulation Study

I-93/I-95 Interchange Improvements, Reading

Land Use & Transportation Discussion Paper

Locating New MassHighway Park-and-Ride Lots

Lower North Shore Transportation Improvement Study

Lynnfield Square Traffic Operations Study

MAGIC Subregional Area Study

Park-and-Ride Lots Phase II: Estimating Demand for MassHighway Park-and-Ride Lots

MIT Lincoln Lab Employee Relocation Study

Newton Lower Falls Area Study

North Shore Bikeway Reconnaissance Study

North Shore Corridor Bus Study

Old Colony Impact Study

Preliminary Feasibility of Saxonville Branch Rail Trail

Ramp Metering Study

Route 1 Corridor Bus Study

Route 1 South Corridor Planning Study

Route 117 Field Reconnaissance Study

Route 138 CPS Milton-Canton-Stoughton

Route 139 Traffic Study, Marshfield-Pembroke

Route 2 Long-Range Corridor Planning Study

Route 2 Origin-Destination Study

Route 20 Corridor Study (Weston-Marlborough)

Route 20 Corridor Study from Boston CBD to Rt 128

Route 28 Traffic Signal Improvement Study

Route 3/3A (Cambridge St.) Corridor Study, Burlington-Winchester

Route 9 Corridor Study in Wellesley

Route 9 Traffic Study Newton-Brookline

Route 9/126 Intersection Redesign

Somerville-Boston Bikeway Reconnaissance Study

South Corridor Bus Service Study

Southeast Expressway HOV Lane Before/After Study

Stoneham Bikeway Reconnaissance Study

Suburban Public Transportation Study

Truck Exclusion Mapping Project

University Avenue/I-93/I-95 Regional Traffic Study

The third source, community comments, is more subjective. Problems expressed through comments stem from people's perceptions and expectations of mobility.

The roadways monitored in the CMS program consist of major arterials and freeways. Over 100 road segments are monitored on a regular basis. Monitoring of roadways is conducted every year, but the roadways included in the program are too numerous to allow monitoring each one every year, so the monitoring is performed in a rotation, each roadway being monitored every three to five years. Each roadway covered by the monitoring program is monitored every three to five years. The program covers roadways that are part of the CMS network. The CMS network consists of all

freeways and arterials in the National Highway System (NHS) along with some non-NHS arterials that were added because of their regional significance or in response to comments. Local streets may be monitored on a one-time basis if specific information is needed in a CMS planning activity. Roadway monitoring is conducted September through May during the weekday AM and PM peak commuter periods.

Route 138 Central Street Intersection in Stoughton

Roadway segments monitored in 1998 and 1999 include freeways, arterials, and local streets. Some of these roadways were selected in accord with the rotational scheduling of CMS monitoring, because they were either not measured or they were undersampled in previous years. Other roadways were selected because they were identified as problematic in the 1997 Transportation Plan or in comments made by citizen planning groups or individuals. Finally, some roadways were monitored to support CMS planning studies, such as the MetroWest Subregional Area Study and the Bus Route 66 Arterial Signal Retiming Study.

Two performance measures are used to measure congestion on each roadway segment monitored: average travel speed (in mph) and delay (in minutes). The performance measures are calculated from travel time data. Travel time data are collected using a test vehicle that travels with the flow of traffic (the “floating car” technique). The test vehicle is equipped with a global positioning system (GPS) that records travel times and distances at one-second intervals between checkpoints on the system.

The threshold used to define congestion for arterial segments is based on average travel speed and the level-of-service (LOS) concept presented in the 1994 Highway Capacity Manual (HCM). LOS is a qualitative congestion measure based on quantitative data (average travel speed). Six levels of service are defined. They are given letter designations, from A to F, with LOS A representing the best operating conditions and LOS F the worst. LOS E represents capacity conditions. Congestion is defined as LOS E-F. For arterials, the CMS threshold for LOS E-F is 15 mph. For freeway segments in the HCM, LOS is not directly based on average travel speed as it is with arterials, but on other traffic flow measures. Therefore, a threshold unique to the CMS has been defined that closely reflects congestion found on freeway segments in the Boston Region MPO. This threshold is 40 mph.

Delay is defined as the condition of a vehicle traveling below 5 mph on a freeway or arterial segment (including stopped time), as long as the speed has been lower than 5 mph for at least 3 consecutive seconds. This delay is different from “stopped delay” because not only stops, but times during which a vehicle is moving very slowly, are included in the delay calculations.

Speeds and delays are calculated for every roadway segment monitored. Short segments could show low speeds, but minimal delays. Longer segments may have high average speeds, but significant delays. The most congested segments will have both low speeds and high delays. The CMS roadway congestion threshold in terms of delay, for both arterials and freeways, is ≥ 1 minute.

A different approach to identifying problems on arterial roadways is being tested in the SouthWest Advisory Planning Committee (SWAP) subregion. This pilot study introduces new data elements that expand our knowledge about transportation system performance and help to define

the CMS planning studies that should be undertaken to improve performance.

The CMS's current monitoring program, as explained above, measures the performance of arterial segments using average speed and delay. The SWAP pilot study attempts to identify more precisely the location and cause of congestion problems by shifting the focus from arterial segments to intersections, which is where most congestion problems originate. The new performance measure used to monitor intersections is traffic queue length. Excessive traffic queue length is a good indicator of problems at intersections and of consequent problems on adjacent arterial segments. Data on traffic queue lengths are collected during the AM and PM peak hours, which is when traffic conditions are at their worst.


Route 1 North

The pilot study adds a safety component by plotting the locations of vehicle, bicycle, and pedestrian collisions. The addressing of bicycle and pedestrian issues is also pursued through inventorying existing facilities, such as bicycle lanes along roadways and crosswalks at intersections. This information will help prioritize bicycle and pedestrian planning needs.

Traffic Safety in the Region

Massachusetts has one of the lowest highway fatality rates in the nation, based on measures of fatalities per licensed driver or fatalities per registered vehicle. In fact, the state highway fatality rate is approximately half of the national rate for these two measures. One of the contributing factors to this record is the effort the state makes to identify and correct high accident locations. The state annually assesses crash data to determine which intersections might be candidates for remedial measures. The Massachusetts Highway Department tracks crash locations as reported in state police reports, local police reports, and operator's accident reports.

Crash locations are ranked based upon the number and severity of crashes occurring over a given three-year period, with each crash involving a fatality being assigned a weight of ten, each crash involving bodily injury a weight of five, and each crash involving property damage a weight of one. Map 5-2 (at the end of the chapter) shows the general location of the top crash locations within the MPO region for the years 1996 through 1998. The majority of high-crash locations occur on the major arterial roadways. In addition to loss of life, injury and property damage, crashes also contribute to increased delay that can cause traffic to be tied up for several hours while the crash is investigated and cleared.

The Central Artery Project

The Central Artery/Tunnel (CA/T) Project is the largest, most complex roadway project in American history. The project includes a tunnel under Boston Harbor, a 14-lane crossing of the Charles River, an eight-to-ten-lane underground expressway to replace the Central Artery, and the extension of I-90 to Logan Airport.

Planning for the Central Artery/Tunnel Project began in 1982. Congress approved funding and the project's basic scope in 1987. Construction began in 1991 on the Ted Williams Tunnel and a bypass road through South Boston. The first project milestone, the Ted Williams Tunnel under Boston Harbor, opened to traffic in December

1995. The second major milestone, the Leverett Circle Connector Bridge, opened in October 1999.

As of November 2001, final design was about 98 percent complete, construction 74 percent complete. The I-90 extension via the Ted Williams Tunnel to Logan Airport is expected to open in 2002. The northbound lanes of the underground Central Artery open in 2002, the southbound lanes in 2003. Demolition of the elevated Central Artery then will commence, with the entire project, including restoration of the surface, completed by 2004. With construction scheduled from 1991 to 2004, the region's economic vitality depends on the project allowing the city to continue to operate.

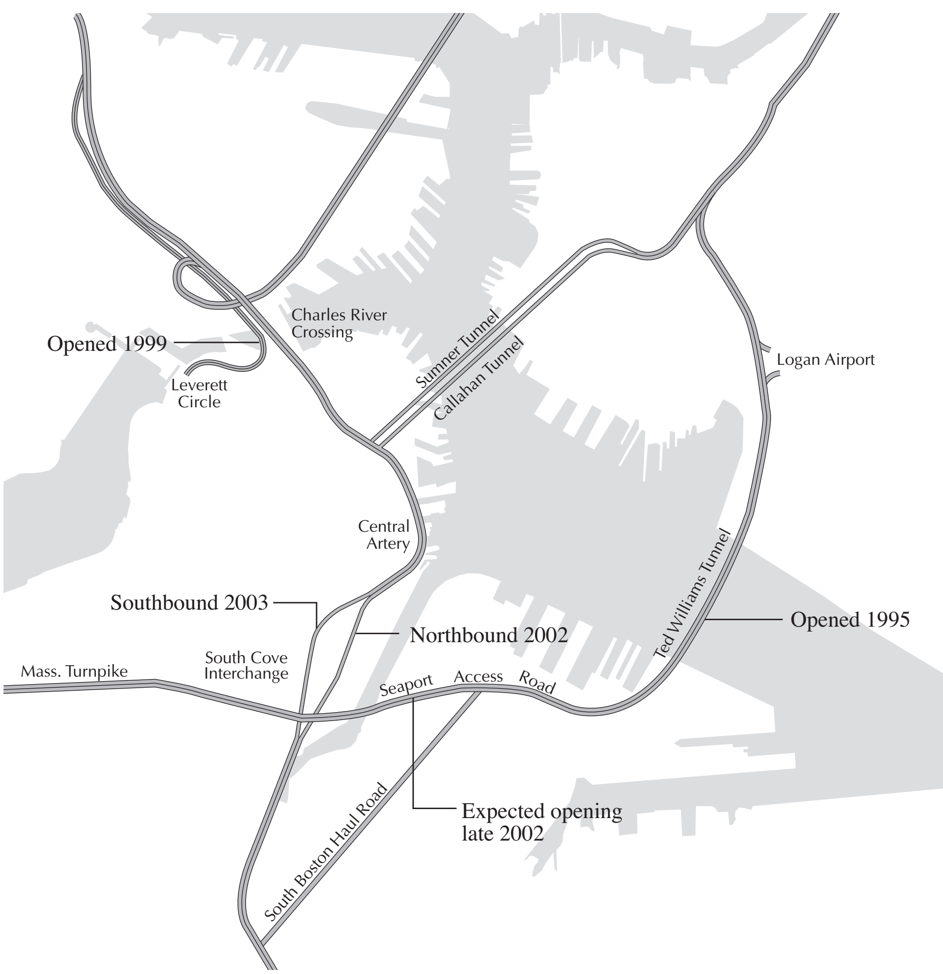
Opened in 1959, the Central Artery comfortably carried about 75,000 vehicles daily. Today it carries upwards of 190,000. The new Central Artery will carry about 245,000 vehicles a day by 2010. The Ted Williams Tunnel, to be opened to all traffic when the extension is complete, is expected to carry 90,000 vehicles a day, compared to 25,000 a day with traffic restricted to commercial vehicles.

Altogether, the CA/T project is building 161 lane-miles of roadway in a 7.5-mile corridor, about half in tunnels, including four major highway interchanges. The old road has 27 on- and off-ramps; the new one will have just 14. The project will create new parks and open space, including 105 acres at Spectacle Island, 33 acres along the Charles River, and 7 acres as part of an expanded Memorial Stadium Park in East Boston. Three quarters of the 27 acres where the existing elevated highway now stands will remain open.

The deepest point of the underground roadway is 120 feet down, beneath the Red Line subway tunnel at Dewey Square (Atlantic Avenue and Summer Street). The highest point is at State Street, where the roadway passes over the Blue Line subway tunnel and the roof of the highway is the street above.

The underground Central Artery will surface near North Station and cross the Charles River on a 10-lane bridge. The bridge will be the widest cable-stayed bridge in the world, and

MAP 5-3
Central Artery Project Status



the first in the United States with an asymmetrical design.

The Metropolitan Highway System

In 1997, the Massachusetts Legislature created the Metropolitan Highway System (MHS) and placed it under the authority of the MassPike. The MHS encompasses the Central Artery, the Central Artery North Area (CANA), the Seaport Access Road, the South Boston Bypass Road, the three harbor tunnels (the Sumner, Callahan, and Ted Williams) and the Massachusetts Turnpike Extension. The MHS does not include the Mystic-Tobin Bridge, operated by Massport.

The MassPike is overseeing the completion of the construction of the CA/T project and will be responsible for the day-to-day operation and maintenance of all of the MHS components. The MassPike maintains separate accounts for the MHS and the Western Cost Center (the Route 128 interchange west to New York).

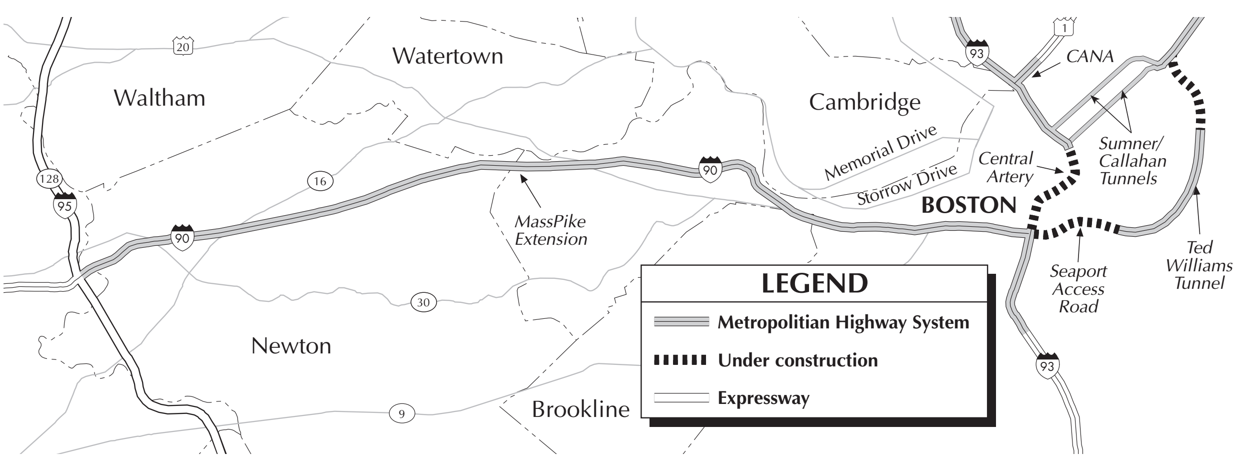
Traffic using the MHS will be monitored by the most advanced traffic management and incident response system in the world, including more than 400 video cameras, 130 electronic message signs, 30 infrared height detectors, and six emergency response stations in operation 24 hours a day.

Other Current or Planned Highway Expansions

In addition to the Central Artery project, several other capital expansion projects are ongoing or planned for the near future. These projects include, but are not limited to:

- The realignment and widening of Route 140 in Franklin. The purpose of this 1.2 mile long project is to widen Route 140 from one lane in each direction to two lanes in each direction from I-495 to Garelick Farms. The alignment of Route 140 will also be altered to accommodate an improved diamond interchange.
- The addition of travel lanes on Route 128 between Randolph and Wellesley. This 13.7 mile long project involves the addition of one travel lane in each direction to increase capacity on a segment of Route 128/I-95. Other towns within the project limits are Canton, Westwood, Dedham and Needham. The project also includes modifications to bridges and the redesign of the Highland Avenue interchange in Needham. The early design phases are active. The project is still under environmental review with MEPA.
- The addition of travel lanes on Route 3 from Burlington to the New Hampshire border.

Map 5-4
The Metropolitan Highway System



Measures to Increase Automobile Occupancies and Efficiencies

The member agencies of the Boston Region MPO have taken numerous measures to provide alternative driving options. Measures that increase vehicle occupancy, help in relieving congestion, or allow for a more efficient use of the roadway network fall under the broad categories of Transportation Demand Management (TDM) and Intelligent Transportation Systems (ITS). TDM measures involve a wide range of strategies such as promoting ride-sharing, allowing for flextime or alternate work schedules, or subsidizing the cost of non-SOV travel.

CARAVAN vanpool

Congestion can be reduced not only by removing vehicles, but by getting them through toll booths more efficiently, and by letting drivers know of congestion ahead so they can plan alternative routes or times for travel. Congestion is not only a nuisance for those in it, but also an expense for businesses and employers, and a source of pollution.

The average round-trip commuting distance for all commuters in Massachusetts is 26 miles. In 1988, it cost drive-alone commuters $2,272 a year to travel this distance. Based on 2001 statistics, drive-alone commuters making a 26-mile daily round trip pay $4,047 annually - an increase of 78%.

For commuters with longer work trips, the cost increases have been more dramatic. For example, the cost of driving alone, 50 miles each way, jumped from $4,816 in 1988 to $8,431 in 2001- an increase of $3615. Commuting 100 round-trip miles a day in a two-person carpool can cut this cost in half. In addition, the cost of commuting in a 14-passenger vanpool, 50 miles each way, was only $1,366 a year in 2001 - an increase of only $462 since 1988.

CARAVAN

As Massachusetts' statewide commuter services organization, CARAVAN provides assistance to commuters, companies, and Transportation Management Associations (TMA) throughout the Commonwealth. A private, nonprofit organization, CARAVAN receives funding from the Massachusetts Highway Department and the Federal Highway Administration.

CARAVAN's 1-888-4-COMMUTE toll-free information line phone number and the "Commuter Information Center" (www.commute.com) provide information from over 50 public and private transportation providers statewide. CARAVAN also operates RideSource, a comprehensive, multimodal commute management system. Callers who become subscribers in the computerized ridematching system receive a customized report containing, on average, 15 transportation alternatives to driving alone. These options include rail, bus, boat, carpool, and vanpool.

The CARAVAN Vanpool consists of approximately 150+ vehicles, with origins all over Massachusetts and Southern New Hampshire. CARAVAN's RideGuide, updated monthly, lists the seats available on commuter vanpools.

CARAVAN administers the statewide Transportation Management Association (TMA) Assistance Program. TMAs are private, nonprofit groups formed by businesses to facilitate private sector involvement in addressing transportation issues. TMAs encourage transit, shared-ride commuting,

and variable work hours to reduce traffic congestion. Some TMAs operate shuttle services among work sites or connecting to transit stops.

CARAVAN analyzes worksite commuter transportation patterns and needs and makes recommendations for transportation demand management (TDM) programs. Programs include parking management strategies, alternative work hour programs, on-site transit pass sales and subsidies, Commuter Choice tax benefits, Commuter Checks, Guaranteed Ride Home services, and the formation of shuttles to transit.

Carpools

According to 1990 U.S. Census data, 12.8% of commuters across the country go to work in a carpool containing 2 or more people. In Massachusetts, 10.8% of commuters travel in 2-to-5 person carpools.

Carpoolers heading to Boston from the north and south can use the High Occupancy Vehicle (HOV) lanes on Route 93 North (for two miles, from Mystic Avenue in Medford to the Route 1/93 merge) and on Route 3 South (for six miles, from Furnace Brook Parkway in Quincy to Freeport Street in Boston). Operated by MassHighway, the lanes are open during the peak morning and evening commuting hours. Many worksites provide preferential parking for carpools, often located near main building entrances.

In addition, commuter groups of three or more can register for the FAST LANE program as a carpool. They pay an annual carpool fee based on the MassPike zone(s) that they travel, which is a considerable discount. To date there are over 1,500 registered carpools in MassPike’s program.

Vanpools

Vanpooling is a cooperative agreement in which 7 to 15 commuters with common schedules share the ride to work. There are cost savings, and other benefits provided to vanpoolers. Massachusetts offers free registration and license plates to all qualified vanpools. Like MBTA commuters, vanpool passengers are eligible to receive a discount on their personal automobile insurance.

In cooperation with the Central Artery/Ted Williams Tunnel Project, the MassPike, the Massachusetts Highway Department, the MBTA, the City of Boston, the MDC, and private property managers, CARAVAN has secured over 100 free and discounted parking spaces. The Boston Transportation Department has designated Vanpool Boarding Zones,conveniently located on major commuting routes throughout the city.

ITS

Intelligent Transportation Systems (ITS) involves the integration of the latest in computers, electronics, communications and safety systems. The Boston Region MPO has participated in the development of Intelligent Transportation Systems (then Intelligent Vehicle Highway Systems) activities in Eastern Massachusetts and the state since 1992. Boston was one of the first cities to complete an FHWA-sponsored metropolitan area deployment plan for ITS, in 1993. The two-phased plan extends to the year 2000. Currently, the various transportation agencies and local governments in the region are revisiting the original ITS plan in order to adopt a new Regional ITS Architecture. This will bring the regional ITS deployment plan into conformity with the Federal Highway Administration's (FHWA) new ITS rule and the Federal Transit Administration's (FTA) new ITS policy.

A new Regional Traffic Operation Center (RTOC) is being constructed in South Boston.This operation center will include eight stations that will assist patrol officers in incident management and detection. Other responsibilities include daily data collection and surveillance. Also implemented is a Motorist Assistance Program that will provide roadside assistance to motorists.

The Central Artery project is incorporating ITS and other advanced technologies into its design, including intensive infrastructure for vehicle detection and surveillance, automatic incident detection, and emissions monitoring.

The I-93 Integrated Transportation Management System Operational Test will cover a 4-mile segment of I-93 immediately north of downtown Boston, including the HOV lane, parallel arterials and the Orange Line. The project will gather real time data on these transportation links, simulate these data and forecast travel time 5-10 minutes into the future on each link. This information will be conveyed to motorists via variable message signs and eventually via in-vehicle devices.

In addition, the Boston Region MPO has contributed to and supported the activities discussed below.

Incident Management

Boston Region MPO staff supported the State's Traffic Management Team with technical analysis and administrative services on the following programs: *SP program, including the development of Public Service Announcement for the program; Motorists Assistance program; and the development of an Operations Manual for Incident Management.

IVHS Strategic Deployment Plan for Metropolitan Boston

During the development of the plan, Boston Region MPO staff served on the technical committee overseeing the project. The plan recommended an Intelligent Vehicle Highway Systems (IVHS) Architecture and the following priority functions:

- Incident Management
- Trip Planning
- Demand Management
- Electronic Toll Collection
- Traveler Information
- Route/Mode Guidance
- Construction Management

Technical Support in MassHighway's Consultant Selection Committees

At the request of MassHighway, the Boston Region MPO staff participated in the evaluation of consultant teams who were hired to execute recommendations from the Early Deployment Plan. Examples include the programs on Motorists Assistance and Advanced Traveler Information Services.

ITS Program Evaluations

The Boston Region MPO performed evaluations of benefits, including delay and air quality reductions, resulting from the application of ITS programs such as Samaritania and the *SP program. Other activities supported by the MPO and its staff include:

- Feasibility of Ramp Metering for Selected Highways: Modeling and other screening tools were used to test the feasibility of installing ramp meters at on-ramps along I-95/Route 128 and selected other locations.
- I-93 Integrated Traffic Management System Operational Test: I-93 and arterial roads in Somerville, Medford and Boston were modeled to simulate incident management strategies for incidents at various segments along the highway.
- HOV Analysis and Monitoring: As part of the Route 128 Transportation Improvement Project, the regional impacts from various HOV, Incident Management, and Transportation Demand Management scenarios were modeled.
- MBTA "B" Green Line Signal Priority Strategies: As part of the Route 20 Corridor Planning Study, the MPO staff evaluated several scenarios pertaining to signal priority along Commonwealth Avenue for the Green Line.
- Traffic Signal Coordination Projects: As part of its corridor planning studies, the MPO routinely uses signal coordination, an ITS strat-

egy, to test operational improvement along arterials.

- ITS Massachusetts and ITS America: MPO staff have been active members of the Technical and Publications Committees of ITS Massachusetts.

SmarTraveler®

In 1992, SmartRoute Systems, in partnership with MassHighway, began operation of the SmarTraveler® Operational Test in Boston, funded by the FHWA Office of Intelligent Transportation Systems and Traffic Operations. SmarTraveler® delivers real-time, on-demand, location-specific traffic and transit information to users with a touch-tone phone, free of charge (617-374-1234 or * 1 on cellular). Traveler information is also disseminated through on-line services, television, radio, and print media. The SmarTraveler® service has been evaluated by MassHighway and has proven highly effective at modifying traveler behavior, and is being incorporated into long-term congestion management plans.

The service area in Eastern Massachusetts covers approximately 1,400 square miles, encompassing 122 communities, an estimated 2.9 million licensed drivers, and 2.8 million registered vehicles. Eighteen separate roadways or roadway segments totaling 701 miles and carrying 1.7 million vehicles daily are covered. The service also includes the MBTA's commuter rail, bus and subway systems.

The SmarTraveler traffic and transit surveillance consists of cameras at strategic locations around greater Boston; "mobile probes" reporting to the operations center by mobile phone or two-way radio; monitoring of 350 publicly available radio frequencies for emergency vehicles, and direct lines to the State Police, Amtrak, MassHighway, and the MBTA.

SmartRoute Systems operates the Interim Operations Center (IOC) for Boston's Central Artery/Third Harbor Tunnel project. Project responsibilities include collecting and communicating data to a variety of target audiences, including the general traveling public, the media, and project personnel. The IOC is a 24-hour-a-day, 7-day-a-week operation that has been operating since 1995.

FAST LANE

FAST LANE is an electronic toll collection system instituted in phases along the Massachusetts Turnpike beginning in October 1998. Vehicles in the FAST LANE system are equipped with a transponder mounted to the windshield behind the rear view mirror. The transponder signals that a vehicle is going through a designated toll plaza. The cost of the toll is then automatically deducted from or charged to a pre-established account. Registered vehicles with FAST LANE transponders can then pass through toll booths without stopping or waiting.

FAST LANE is in operation statewide on the Massachusetts Turnpike, at the Ted Williams Tunnel, the Sumner / Callahan Tunnels, the Tobin Bridge, and is interoperable with EZPass, the electronic toll system used in New York, New Jersey, Delaware, Pennsylvania, West Virginia, and Maryland.

Conclusion

The regional roadway infrastructure, while in fairly good condition, is relatively mature. As such, one of the major challenges in the transportation plan process is determining the appropriate level of funding to reserve for system rehabilitation and reconstruction, while also providing sufficient capital to judiciously expand the existing roadway system or maximize system usage. As with most transportation plan issues, an underlying concern affecting the MPO's decision-making process will be the interaction between transportation funding decisions and local land-use and regional economic development.

Additionally, it is important for the MPO to focus on measures to improve the efficiency of the existing system through transportation demand management measures and ITS, and to ensure

that the character and historical quality of the communities of the region is preserved.

Accordingly, issues that are addressed in subsequent chapters of this plan include:

- Identifying the appropriate level of investment in the current system, sufficient to maintain and improve the region's existing roadways and bridges.
- Selecting capital expansion projects to improve mobility where needed and prudent.
- Promoting strategies for alternatives to single-occupancy travel and taking advantage of technology to improve the efficiency of the roadway system
- Analyzing the impact of transportation decisions on land-use and regional economic development.

Map 5-2
Highest Crash Locations
1996-1998

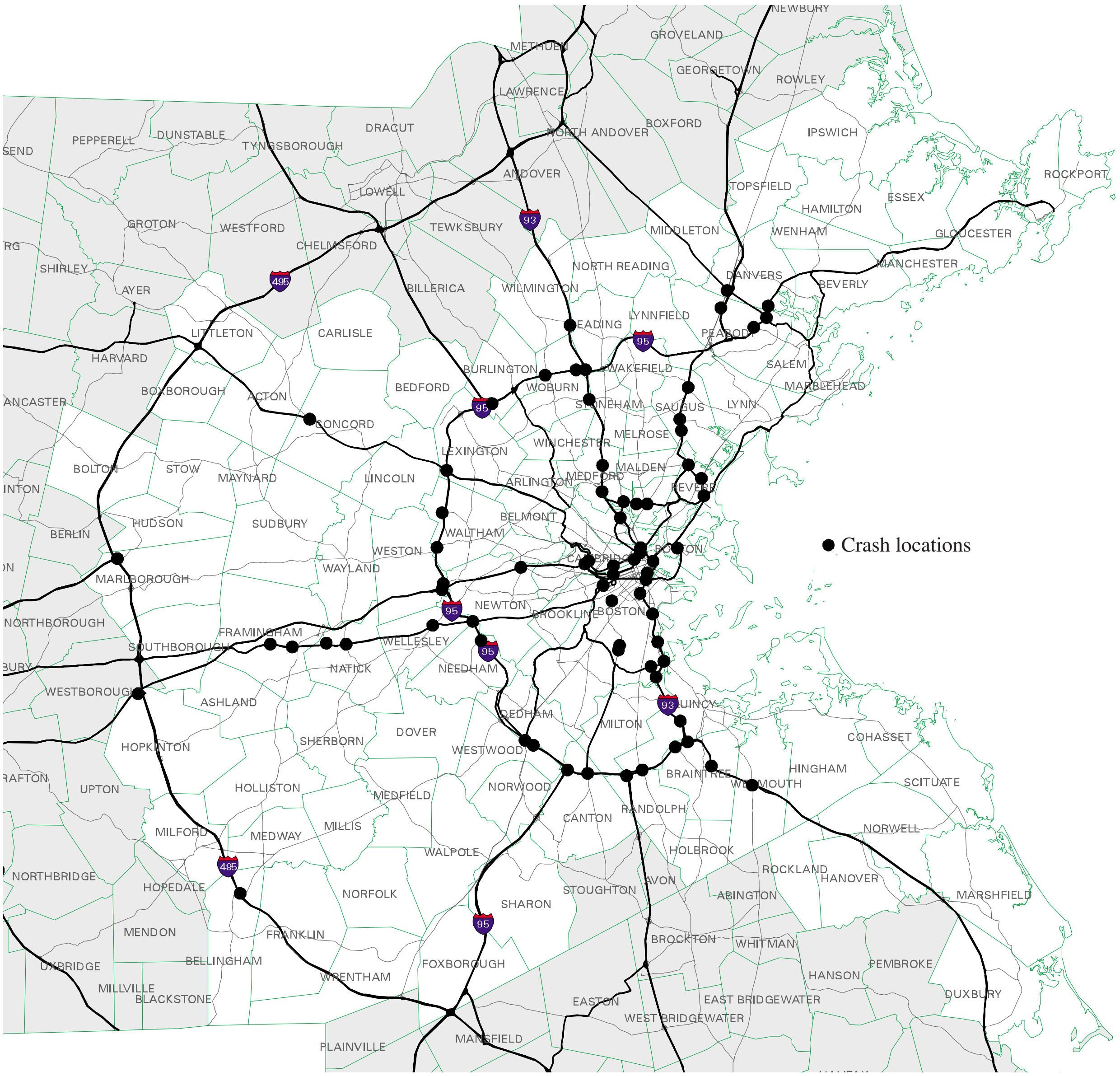
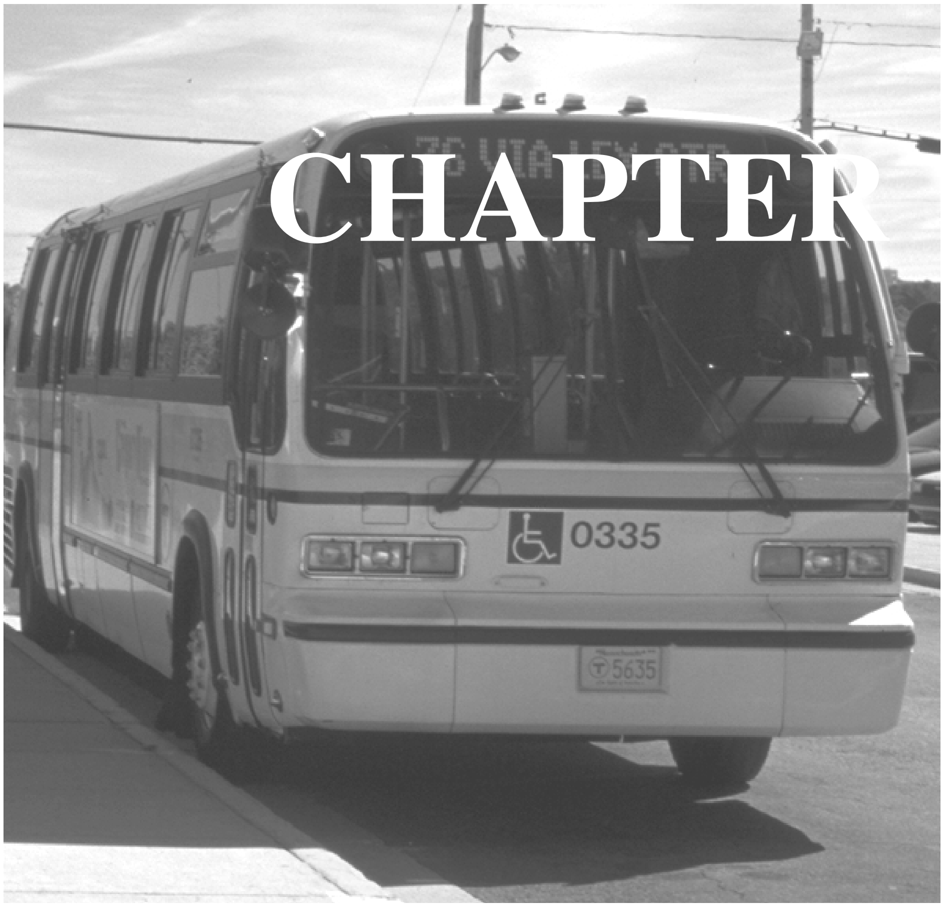


Table 5-3
Crash Locations

City or Town	Intersecting Streets	City or Town	Intersecting Streets
Bellingham	Hartford Avenue & I-495	Lexington	I-95 & Route 2
Boston	Leverett Circle	Marlborough	I-290 & I-495
Boston	Route 1 & Route 129	Medford	Route 16 & the Fellsway
Boston	Charlesgate West & Storrow Drive	Medford	Mystic Valley Pkwy & I-93
Boston	Airport Road	Medford	Roosevelt Circle & I-93
Boston	Route 1A & I-93	Milton	Granite Avenue & I-93
Boston	Kneeland Street & I-90	Natick	Route 27 & Route 9
Boston	Route 1 & I-93	Natick	Route 9 & Speen Street
Boston	Columbia Road & I-93	Needham	Route 128 & Highland Avenue
Boston	Mass Ave & Melnea Cass Blvd	Newton	Centre Street & Washington Street
Boston	Brookline Avenue & the Riverway	Peabody	Lowell Street & Route 1
Boston	Charles Circle & Embankment Road	Peabody	Andover Street & Route 128
Boston	Cambridge Street & Soldiers Field Road	Peabody	Lowell Street & Route 128
Boston	Cambridge Street & I-90	Quincy	Furnace Brook Rotary & I-93
Boston	Blue Hill Avenue & Talbot Avenue	Quincy	Route 24 & I-93
Boston	American Legion Hwy & Blue Hill Avenue	Quincy	Route 28 & I-93
Boston	Adams Street & Gallivan Boulevard	Reading	I-95 & I-93
Boston	Freeport Street & Morrissey Boulevard	Revere	Bell Circle
Boston	Gallivan Boulevard & Neponset Avenue	Revere	Copeland Circle
Boston	Columbus Avenue & Tremont Street	Revere	Brown Circle & Squire Road
Braintree	Granite Street & I-93	Saugus	Route 1 & Route 129
Braintree	Route 3 & I-93	Saugus	Main Street & Route 1
Braintree	Route 3 & Union Street Rotary	Saugus	Essex Street & Route 1
Burlington	Middlesex Turnpike & I-95	Somerville	I-93 & Mystic Avenue
Cambridge	Mass Ave & Memorial Drive	Waltham	Route 128 & Winter Street
Canton	I-95 & I-93	Waltham	Route 128 & Route 20
Canton	I-93 & Route 138	Wellesley	Route 128 & Route 9
Concord	Route 2 & Route 2A Rotary	Wellesley	Route 16 & Route 9
Danvers	Route 1 & Route 114	Weston	Route 128 & I-90
Danvers	Endicott Street & Route 128	Weston	Route 128 & Route 30
Dedham	Route 1 Ramp & I-95	Westwood	East Street Rotary & Route 128
Everett	Route 16 & Route 99	Weymouth	Route 18 & Route 3
Everett	Route 16 & Santilli Circle	Wilmington	Route 129 & I-93
Framingham	Route 30 & Route 9	Woburn	Route 128 & Route 38
Framingham	Main Street & High Street	Woburn	Route 128 & Washington Street
Hopkinton	I-90 & I-495	Woburn	Montvale Avenue & I-93



CHAPTER 6

TRANSIT SYSTEM

The region's public transportation network plays a vital role in providing mobility for residents and visitors who prefer not to drive or are unable to drive, sustaining a high quality of life and environment, and fueling the regional economic growth. The Boston metropolitan area is served by a hub-and-spoke network of rapid transit, streetcar, express bus, commuter rail and commuter boat lines. Where available, these services provide high quality and cost-effective commuting alternatives to the single-occupant automobile. Local bus and trackless trolley services fill in the gaps between spokes by offering line-haul service in heavily congested areas, feeder services to rail, and inter-suburban linkages throughout the region. Demand-response transportation for people with disabilities and the elderly, is also provided.

THE EXISTING PUBLIC TRANSIT SYSTEM

The Massachusetts Bay Transportation Authority (MBTA) is the primary transit provider in the region. The MBTA directly operates or contracts out for service using seven different modes: heavy rail, streetcar, local/express bus, trackless trolley, commuter rail, commuter boat and paratransit. While the commuter rail network extends beyond the MPO region to the far reaches of the MBTA's 188 community district, local MBTA bus service is limited to an area extending from Boston to just beyond Route 128. Rapid transit and streetcar service is limited to the inner core communities. Local bus service in the Gloucester/Rockport area is provided by the Cape Ann Transportation Authority (CATA).

Rapid Transit and Streetcar

The MBTA rapid transit and streetcar systems serve 125 stations on five lines: The Red Line, Orange Line, Blue Line, Green Line and Mattapan High Speed Line. Daily ridership on the rapid transit/streetcar system is approximately 679,000 trips per weekday. All the ridership data reported in this chapter is a composite average for FY 2001 and reported as unlinked trips. The source for all of the data in this

chapter is either the MBTA or CTPS as part of the MBTA's ongoing data collection effort. The data for maximum load capacity for fleet vehicles includes passengers seated and standing.

Red Line

Of the three rapid transit lines, the Red Line is the longest at 21 miles, and the most heavily utilized, generating an average 226,812 trips per weekday. There are 22 stations on the Red Line, 17 of which are accessible. Service runs on two branches, between Alewife Station in North Cambridge and Ashmont Station in Dorchester or Braintree Station in Braintree. Communities directly served are Cambridge, Somerville, Boston, Quincy, and Braintree. All service operates along a common alignment between Alewife and the JFK/UMass Station in Dorchester, at which point service branches off to either Ashmont or Braintree. Throughout most of the day, service is split equally between the two branches. The MBTA runs 6-car trains during the a.m. and p.m. peak hours and 4-car trains at other times. There are 218 cars in the Red Line fleet. The fleet consists of 74 cars built in 1969, 58 cars built in 1987-88, and 86 cars built in 1994. During the peak hour, 170 passengers per car is considered maximum load. Park-and-ride facilities provide over 11,000 parking spaces. Rush hour trains

Map 6-1
MBTA System

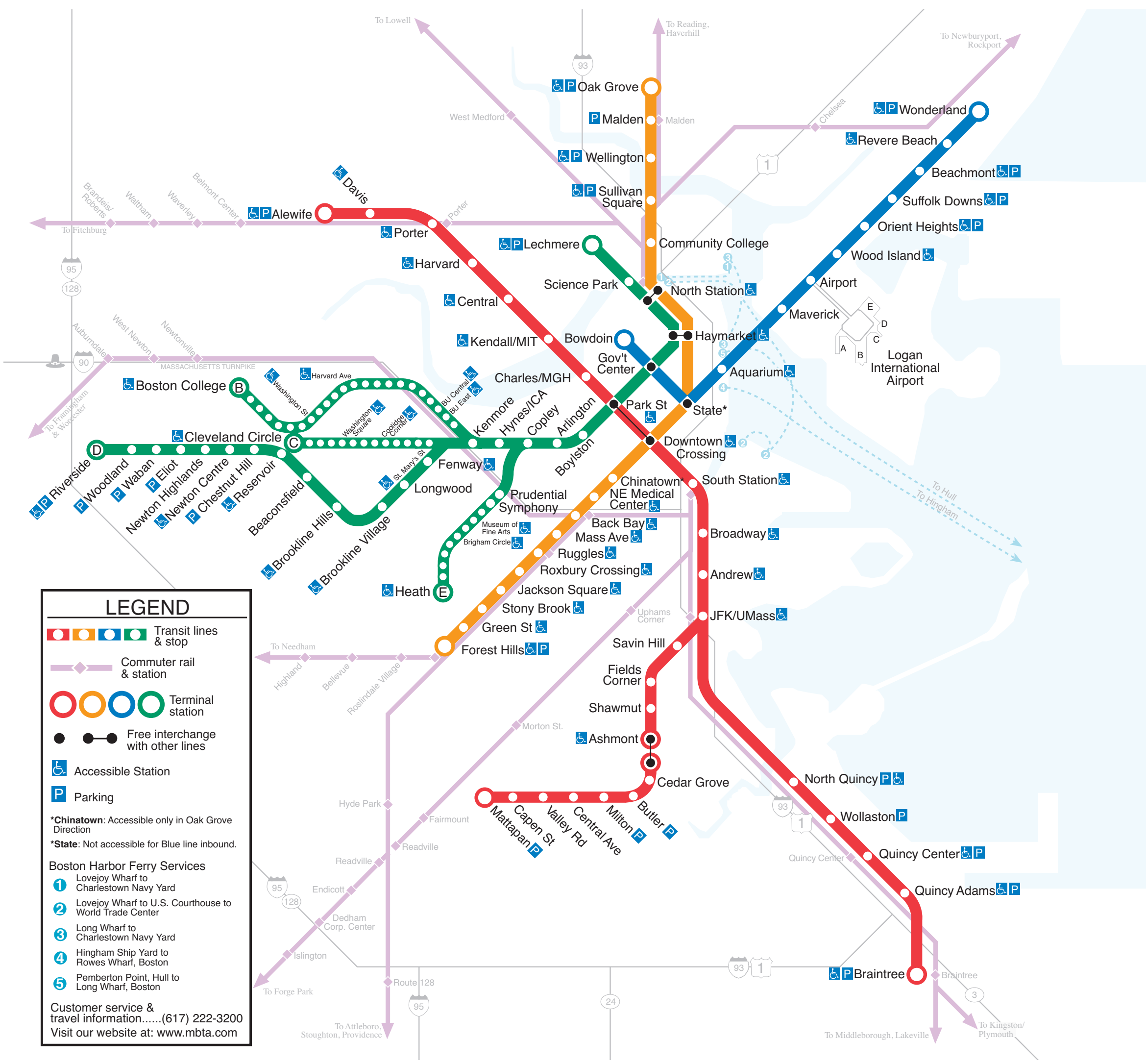


TABLE 6-1
MBTA Vehicle Fleet by Year Built

Quantity/Type of Vehicles	Year Built
Diesel Bus	
198	1985
180	1986
200	1989
137	1994
261	1995
Alternative Fuel Bus	
4	1999
Trackless Trolley	
40	1976
Green Line	
55	1976-78
95	1986-87
20	1997
100	1999-2001 (Delivery halted)
Mattapan-Ashmont	
11	1945 (rebuilding program underway)
Red Line	
74	1969 (rebuilt 1985-88)
58	1987-88
86	1994
Orange Line	
120	1979-81
Blue Line	
70	1978-80
Commuter Rail Coaches	
57	1979 (rebuilt 1996)
40	1987
67	1987-88
107	1989-90
75 (bilevel)	1990-91
17 (bilevel)	1997
15 (bilevel)	2001-2002
Commuter Rail Locomotives	
13	1978
5	1980
25	1987-88
9	1991
3	1993
25	1997 (remanufactured)

operate at 8 minute intervals from Braintree and Ashmont and at 4 minute intervals between JFK/UMass and Alewife. Average speeds on the Braintree and Ashmont branches are 23.3 mph and 19.2 mph respectively. Peak hour capacity totals 12,200 passenger trips.

Mattapan High Speed Line

The Mattapan High Speed Line connects with the Red Line and operates between Ashmont and Mattapan through the Dorchester neighborhood of Boston and the town of Milton. Service is provided by 11 PCC streetcar vehicles built in 1945-46. A program is underway to rebuild this equipment and extend its service life by another 15 years. The line can be considered an extension of the Red Line in most respects, but its vehicles are maintained and operated as part of the Green Line fleet. The Mattapan High Speed Line vehicles run as single cars. The line, 2.7 miles long, has eight stations, close to 300 parking spaces and generates 7,752 passenger trips per weekday.

Orange Line

The Orange Line is 11 miles long and operates between Oak Grove on the Malden/Melrose line and Forest Hills in Jamaica Plain serving the communities of Malden, Medford, and Boston. 15 of its 19 stations are accessible (work is in progress at Chinatown-southbound and North Station), and 170,873 trips are generated each day. The Orange Line fleet consists of 120 vehicles built in 1979-81. During the peak hour, 130 passengers per car is considered maximum load. Park-and-ride facilities provide over 5,400 spaces. The MBTA runs 6-car trains during weekday

TABLE 6-2
Characteristics of the Rapid Transit System

	Fleet Size (# Cars)	Trains	(# Cars/ Train)	Req'mt (# cars)	Headway (Minutes)
RED LINE	218	27	6	162	4
Ashmont		11	6	66	8
Braintree		16	6	96	8
MATTAPAN	11	6	1	6	4
ORANGE LINE	120	17	6	102	5
BLUE LINE	70	14	4	56	3.5
GREEN LINE	170	74	2	148	1.3
Boston College		22	2	44	4.5
Cleveland Circle		13	2	26	6.5
Riverside		26	2	52	4.5
Heath Street		10	2	20	9
Run-as-Directed		3	2	6	

Note: *1.3 minute Green Line headway is between Government Center and Copley, and 4 minute Red Line headway is between Alewife and JFK/UMass.*

peak and midday hours and 4-car trains at all other times. Rush hour trains operate at 5 minute intervals at an average speed of 20.2 mph. Peak hour capacity is approximately 10,140 passenger trips. The MBTA plans to improve the signal system between Haymarket and Oak Grove to match the signal capabilities already in place on the remainder of the line. The MBTA also plans to increase the Orange Line fleet by between 18 and 24 cars. This equipment will be rebuilt from former Blue Line cars.

Blue Line

The six mile long Blue Line is the shortest of the three heavy rail lines and operates between Wonderland Station in Revere and Bowdoin Station in the Government Center area of Boston. Twelve stations, eight of which are accessible (work is ongoing at Airport), generate 59,394 weekday trips. The Blue Line fleet consists of 70 vehicles built in 1978-80 and 95 passengers per car is considered the maximum load. Park-and-ride facilities provide over 3,900 spaces. Rush hour trains operate at 3.5 minute intervals at an average speed of 18.7 mph. All trains are 4 cars in length at all times. Peak hour capacity totals 6,460 passenger trips. The MBTA plans to eventually operate 6 car trains on the Blue Line, and is in the process of procuring a new fleet of 94 vehicles for Blue Line service.

Green Line trolley

Green Line

The Green Line, which uses light rail vehicles (LRVs), generates approximately 215,000 trips per weekday over 23 miles of track in Cambridge, Boston, Brookline, and Newton. The line is composed of 70 stations, 13 of which are underground or elevated in the Central and Huntington Avenue subways. 13 other stations are on the surface rapid transit Highland branch (D-branch) of the Green Line. The remaining 44 stations are surface stops on three streetcar branches to the west and southwest of downtown Boston: the Boston College branch (B Line) with 22 stops, the Cleveland Circle branch (C Line) with 13 stops, and the Heath St. branch (E Line) with 9 stops. 13 of the 70 Green Line stations are accessible. The northern terminus of the Green Line is at Lechmere Station in Cambridge; Heath Street and Riverside trains operate that far. Because ridership north of downtown Boston is much lower than to the west and southwest, Boston College and Cleveland Circle trains turn around at Government Center. There are 170 LRVs in the Green Line fleet (with an expansion to a 215 car fleet by 2002). The Green Line streetcar vehicle fleet consists of 55 cars built in 1976-78, 95 built in 1986-87, and 20 built in 1997. Delivery of 100 low-floor cars began in 1999, however delivery has been halted due to mechanical problems. These cars are intended to replace the 55 cars built in 1976-77. 110 passengers per car is considered maximum load. Park-and-ride facilities provide over 1,900 spaces. Rush hour trains operate at 5 to 8 minute intervals on the four branches and at 1.3 minute intervals between Copley and Government Center stations. Peak hour capacity totals 9,020 passenger trips.

Bus and Trackless Trolley

The MBTA operates approximately 170 bus routes throughout the MBTA district serving the following 44 municipalities:

Arlington, Bedford, Belmont, Beverly,

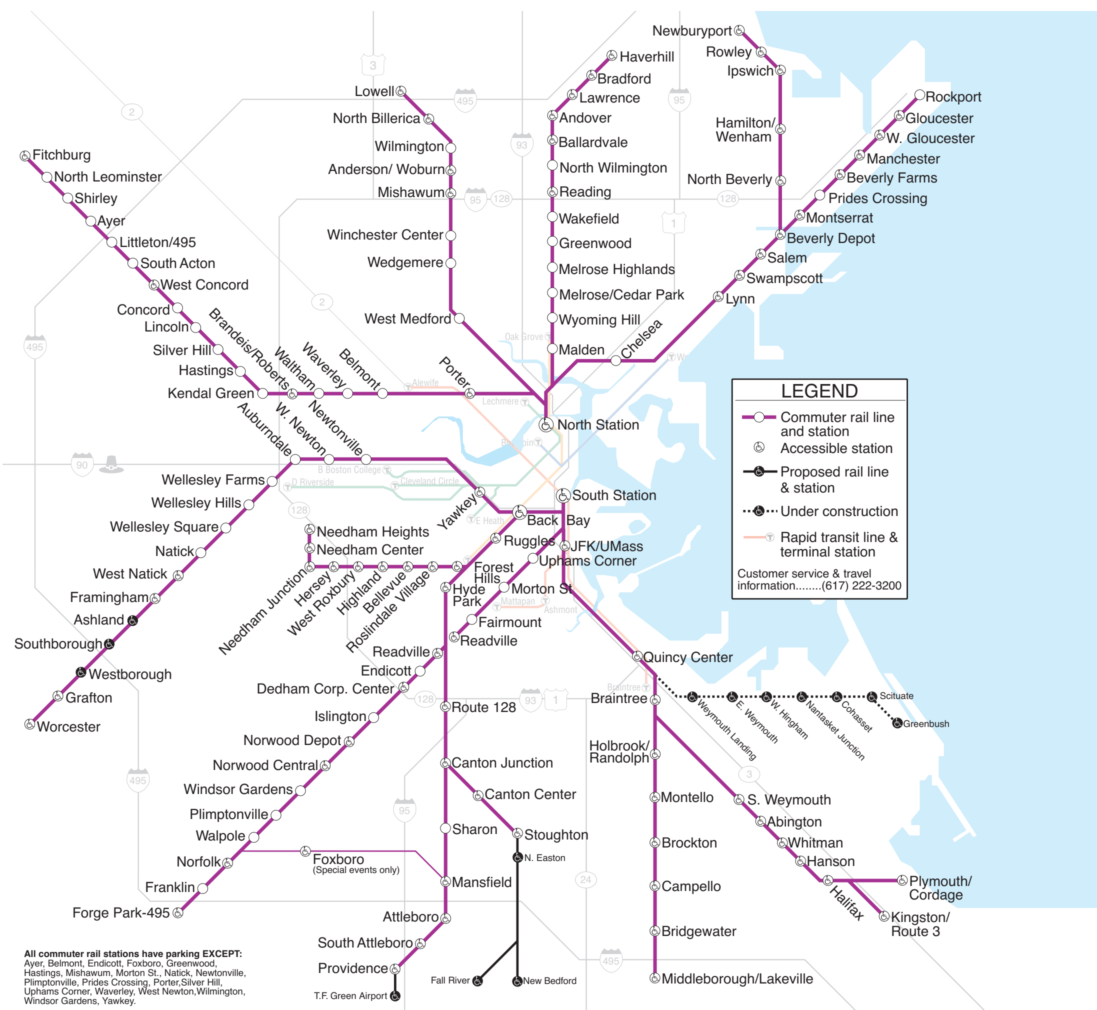
Boston, Braintree, Brookline, Burlington, Cambridge, Chelsea, Danvers, Dedham, Everett, Hingham, Holbrook, Lexington, Lynn, Malden, Marblehead, Medford, Melrose, Milton, Nahant, Needham, Newton, Norwood, Peabody, Quincy, Randolph, Reading, Revere, Salem, Saugus, Somerville, Stoneham, Swampscott, Wakefield . Walpole, Waltham, Watertown, Westwood, Weymouth, Winchester, and Woburn

Four electric trackless-trolley lines also operate in Cambridge, Watertown and Belmont.

In FY 2001, total bus and trackless trolley ridership was approximately 376,000 trips per weekday.

Nearly all routes connect with the rapid transit system. In areas close to the Boston urban core, bus service provides crosstown service, feeder service to rapid transit stations, and line haul service in heavily congested areas. Further out, buses provide local service and feeder service to rapid transit and some commuter rail lines. The MBTA bus fleet consists of 378 diesel buses built in 1985-87, 200 diesel buses built in 1989, 398 diesel buses built in 1994-95, and 4 alternative-fuel vehicles built in 1999. The fleet also includes 40 electric trackless trolleys built in 1976. The MBTA is in the process of procuring additional alternative fuel buses including CNG buses, dual-mode vehicles for the South Boston Transitway and new trackless trolleys to replace the present fleet.

Map 6-2
Commuter Rail System



The MBTA operates express bus routes service to Boston from 11 communities: Newton, Watertown, Waltham, Medford, Burlington, Woburn, Lynn, Marblehead, Nahant, Salem, Saugus, Swampscott, and the Boston neighborhood of Brighton.

Buses serve over 8,500 stops, approximately 360 of which are equipped with bus shelters. Park-and-ride lots for bus service have over 400 parking spaces. The present MBTA bus network consists mostly of routes taken over from the Metropolitan Transit Authority (MTA) in 1964 and several previous private operators. Most of these routes have lengthy histories, and many had their origins as streetcar lines built before 1900. Schedules and route alignments have been revised gradually over the years, but most continue to operate along the same general alignments in response to continuing demand.

The MBTA is presently building the Silver Line, a Bus Rapid Transit (BRT) system serving several corridors. On Washington St., between Dudley Sq. and Downtown Crossing, the Silver Line will consist of a busway featuring bus priority lanes, shelters, real-time schedule information, electronic signage, a public address system, and an intercom assistance system. Between South Station and the World Trade Center, the Silver Line will make use of an underground transitway with stops at South Station, the Federal Courthouse, and World Trade Center. The dual-mode vehicles will then continue on the surface, providing direct service to the new Boston Convention Center, the Boston Marine Industrial Park, and to Logan Airport. These Washington St. and South Boston segments will be connected by a new underground tunnel between New England Medical Center and South Station with stops at Boylston St. (Green Line connection) and Chinatown (Orange Line connection). Service on Washington St. is projected to start in 2002, service from South Station to the World Trade Center in 2003, and between New England Medical Center and South Station in 2008.

Commuter Rail

The 265-mile commuter rail network is comprised of 13 radial lines, with 123 stations (79 of which are accessible). In FY 2001, weekday ridership was over 127,000. The commuter rail system is split into two sides. Northside service operates to and from North Station, and southside service to and from South Station. The Mass. Turnpike can be considered the dividing line between North and South Station service: all routes north of the Turnpike—the Rockport, Newburyport, Haverhill, Lowell, and Fitchburg lines operate to and from North Station. Lines along the Mass. Turnpike or to the south—the Framingham, Needham, Franklin, Attleboro/Providence, Stoughton, Fairmount, Middleborough, and Kingston/Plymouth lines – operate to and from South Station. All southside lines except the Fairmount Line, Middleborough Line, and Kingston/Plymouth Line also serve Back Bay Station.

The 72 municipalities served directly by commuter rail are:

> Abington, Acton, Andover, Attleboro, Ayer, Belmont, Beverly, Billerica, Boston, Braintree, Bridgewater, Brockton, Cambridge, Canton, Chelsea, Concord, Dedham, Fitchburg, Framingham, Franklin, Gloucester, Grafton, Halifax, Hamilton, Hanson, Haverhill, Holbrook, Ipswich, Kingston, Lakeville, Lawrence, Leominster, Lincoln, Littleton, Lowell, Lynn, Malden, Manchester, Mansfield, Medford, Melrose, Middleborough, Natick, Needham, Newburyport, Newton, Norfolk, Norwood, Plymouth, Providence RI, Quincy, Randolph, Reading, Rockport, Rowley, Salem, Sharon, Shirley, Stoughton, Swampscott, Wakefield, Walpole, Waltham, Wellesley, Wenham, Weston, Westwood, Weymouth, Whitman, Wilmington, Winchester, Woburn, and Worcester.

New stations are under construction on the Worcester line at Ashland, Southborough, and Westborough. New commuter rail lines planned include the Greenbush line which will serve Wey-

mouth, Hingham, Cohasset, and Scituate, and the New Bedford/Fall River service which will include stations in Easton, Raynham, Taunton, Freetown, Fall River, and New Bedford. The states of Rhode Island and New Hampshire are also considering the expansion of the network, with Rhode Island developing an extension of the Providence line to T. F Green airport and New Hampshire considering the extension of the Lowell line to Nashua NH and the Haverhill line to Plaistow NH.

The commuter rail passenger coach fleet consists of 378 vehicles: 57 single-level coaches built in 1979 and rebuilt in 1996, 214 single-level coaches built in 1987-90, 75 double-deck coaches built in 1990-91, 17 double-deck coaches built in 1997, and 15 double-deck coaches delivered in 2001-2002. Double-deck coaches have seating capacities of 182 vs. 127 for a single-level car.

Commuter boat

The commuter rail locomotive fleet consists of 83 units: 18 units built in 1978-80, 25 units built in 1987-88, 12 units built in 1991-93, and 25 remanufactured units delivered in 1997-99. The fleet also includes 3 work locomotives built in the 1950s which are used for non-revenue duties.

A total of 457 weekday inbound and outbound trips are scheduled, with headways ranging from 25 to 40 minutes during peak periods, and from one to four hours during off-peak times. Over 30,000 park-and-ride spaces are provided, or under construction, for commuter rail riders.

Commuter Boat

- MBTA commuter boat service is operated by two contractors and operates between: Hingham and Rowes Wharf (Boston)
- Point Pemberton in Hull and Long Wharf (Boston)
- the Charlestown Navy Yard and Long Wharf
- the Charlestown Navy Yard and Lovejoy Wharf (Boston)
- Lovejoy Wharf to World Trade Center via the Federal Courthouse (Boston).

A total of 1,815 parking spaces are provided in Hingham and Hull. The total annual ridership in Fiscal Year 1999 was 1.2 million passengers.

Key Stations Program

The Americans with Disabilities Act (ADA), which was passed by the federal government in 1990, mandated improvements to a wide variety of facilities and infrastructure throughout the country to ensure that they are accessible. This created particular challenges for the MBTA, whose subway system is the oldest in the nation. The age of the system, combined with the fact that more than half of the MBTA's metro and light-rail stations are streetcar stops, resulted in the Federal Transit Administration approving the MBTA's Key Station Program. This program designates 80 stations in the MBTA system that must be brought into compliance with ADA.

The Key Stations consist of several commuter rail and heavy rail stations that were not previously compliant, most Green Line subway stops, and several important Green Line surface stops. Currently, 46 of these 80 stations are compliant, and 32 more are in design or construction stages. Any new stations, such as those on recent commuter rail extensions to Worcester, Newburyport, Middleborough and Plymouth, must be built in com-

pliance with ADA although they are not included in the Key Station Program. Recently modernized Blue Line Stations not included in the program were also brought into compliance.

In the first couple of years of the program, the MBTA succeeded in bringing all but seven commuter rail Key Stations into compliance. Compliance has since been achieved at Bradford, Fitchburg, and Route 128 stations. Work at Framingham and Canton Junction Stations was completed in 2001. Work remains to be done at Fairmount station and Malden station.

Aquarium Station

The majority of work that remains in the Key Station program is on the Green Line's downtown subway and Green Line surface routes. Surface stations in the program are those at the transfer points between the Green Line and major bus routes (Coolidge Corner, Harvard Avenue, Brookline Village, etc.) and those that serve large academic and medical institutions (BU Central, BU East, Brigham Circle, etc.). All transfer points between the Blue, Red, Orange, Green and commuter rail lines are also in the program. Underground and elevated Green Line stations included in the Key Station plan are Lechmere, North Station, Haymarket, Government Center, Park St., Arlington, Copley, and Kenmore. Stations on the Highland Branch include Fenway, Brookline Village, Reservoir, Newton Centre, and Riverside. Surface streetcar stops on the B, C, and E lines include: BU East, BU Central, Harvard Ave., Washington St., Boston College, St. Mary's St., Coolidge Corner, Washington Sq., Cleveland Circle, Northeastern, Museum Fine Arts, Longwood Medical, Brigham Circle, and Heath St./ VA Med. Temporary access has been achieved at 13 stations including Park St., North Station, and Lechmere through the use of portable wayside lifts. Construction of raised platforms which will be compatible with low-floor cars has been completed at four stations on the Riverside branch. Construction of raised platforms is planned at surface Key Stations on the B, C, and E lines. The two terminal stations of the Mattapan-Ashmont line are also designated as Key Stations.

Work is presently underway to upgrade the Chinatown (outbound) station on the Orange Line. North Station was completed in 2001. Orange Line stations at Malden and Community College will also be made accessible under the Key Station program. Design work is presently underway to replace the Charles station facility on the Red Line, making it accessible. Although not designated as Key Stations, Red Line stations at Savin Hill, Fields Corner, and Shawmut are slated for major renovations which will include providing accessibility.

Work is presently underway to provide new improved Blue Line facilities at Airport station. Aquarium station opened in 2001. Design work continues to upgrade Blue Line stations at Maverick, State, and Government Center.

PARATRANSIT

The RIDE service is a paratransit program operated by private carriers under contract to the MBTA that provides transportation to people who cannot use fixed-route public transportation because of disabilities. The RIDE operates sedans and lift-equipped vans within the MBTA district in the following 62 municipalities:

> Arlington, Bedford, Belmont, Beverly, Boston, Braintree, Brookline, Burlington, Cambridge, Canton, Chelsea, Cohasset, Concord, Danvers, Dedham, Dover, Everett,

Framingham, Hingham, Holbrook, Hull, Lexington, Lincoln, Lynn, Lynnfield, Malden, Marblehead, Medfield, Medford, Melrose, Middleton, Milton, Nahant, Natick, Needham, Newton, Norwood, Peabody, Quincy, Randolph, Reading, Revere, Salem, Saugus, Sharon, Somerville,Stoneham, Swampscott, Topsfield, Wakefield, Walpole, Waltham, Watertown, Wellesley, Wenham, Weston, Westwood . Weymouth,, Wilmington, Winchester, Winthrop, and Woburn

In FY 2001, annual ridership was over 1 million riders.

Overall, the RIDE program operates a fleet of over 300 vans and sedans to provide its services.

The RIDE

Private-Carrier and Suburban Bus Service

Five private carriers provide regular local bus transportation in East Boston, Winthrop, Peabody, Salem, Medford, Milton, Canton, Hingham, and Hull under contract to the MBTA. Annual ridership in Fiscal Year 2001 was 691,000 passengers.

Nine additional private carriers are subsidized through the MBTA's Inter-District Transportation Program (ITP) to provide commuter service to Downtown Boston from the following communities:

Amesbury, Andover, Barnstable, Bourne, Boxford, Bridgewater, Canton, Dighton, Dover, Duxbury, Easton, Fall River, Framingham, Georgetown, Groveland, Hanover, Haverhill, Hudson, Kingston, Lawrence, Marlborough, Marshfield, Medfield, Medway, Methuen, Middleborough, Middleton, Milford, Millis, Newbury, Newburyport, Northborough, Norwell, Peabody, Pembroke, Plymouth, Raynham, Rockland, Sandwich, Shrewsbury, Somerset, Southborough, Sudbury, Taunton, Topsfield, Wayland, West Bridgewater, Westborough, Worcester

The same program also finances local services from Framingham to the surrounding towns of Ashland, Holliston, Hopkinton, Marlborough, Milford, and Southborough, and a commuter service from Braintree Station to Hanover, Marshfield, and Plymouth. Annual ITP ridership for Fiscal Year 2001 was 593,724.

Nine private carriers also operate commuter service to Boston and are not included in the ITP. These carriers provide service to Abington, Acton, Braintree, Cohasset, Concord, Fairhaven, Fall River, Falmouth, Harwich, Hingham, New Bedford, Newburyport, Orleans, Scituate, Springfield, Wareham, Weymouth, Whitman, as well as locations in Rhode Island, New Hampshire, and Maine.

The MBTA also provides funding to local communities to operate their own local transit systems. The Suburban Bus Program is geared toward low density communities where regular MBTA service would not be cost-effective. The program, begun in 1979, subsidizes 11 communities: Bedford, Beverly, Burlington, Dedham, Framingham, Lexington, Lynn, the Mission Hill neighborhood of Roxbury, Natick, Needham, and Norwood. Some communities operate fixed-route bus service, while others use the program to operate demand-response service with vans or through taxi-vouchers. Annual ridership in Fiscal Year 2001 was 452,879 passengers.

Newton, Concord, Waltham, and Peabody operate local bus services which are not included in the Suburban Bus Program.

Transportation Management Associations

Transportation Management Associations (TMAs) are non-profit coalitions of local businesses dedicated to reducing traffic congestion and pollution and improving commuting options for their employees. The Boston and Cambridge TMAs each serve a specific business area, while the Suburban TMAs serve several businesses within their community. Several support shuttle services which connect employment locations with MBTA rapid transit or commuter rail stations. While some of these services are only available to employees of member companies, others are open to the general public to ride. One of the most well established services is the Alewife-Route 128 Waltham shuttle operated by the Route 128 Business Council.

Cape Ann Transportation Authority Bus

Cape Ann Transportation Authority

The Cape Ann Transportation Authority provides local service in the towns of Gloucester and Rockport, and also operates Saturday service from Gloucester to shopping centers in Danvers and Peabody. In 2001, the CATA fleet consisted of 12 buses and demand response vans. Annual ridership was 344,817 for bus service and 35,788 for vans.

ITS Integration and the MBTA

Intelligent Transportation Systems (ITS) has a number of useful applications with the provision of transit services. The use of ITS can help the MBTA provide a more user-friendly on-time service to its clients. The MBTA is integrating ITS into its operations in several ways. The Operations Control Center (OCC) was upgraded in the late 1990s to provide improved monitoring and location information for the rapid transit system. This control center allows operators to have real-time information on service and accidents and plan service changes accordingly.

A new bus operations center will soon be added to the rapid transit facility which will integrate global positioning systems on its fleet of buses so that it can better schedule and direct its bus fleet. Automatic stop announcement equipment has been installed on the MBTA's crosstown bus routes. The MBTA's Silver Line buses will be equipped with GPS-based Automatic Vehicle Location (AVL) technology.

The MBTA is moving forward with procuring new fare collection equipment. Both magnetic-strip fare media and contactless "smart cards" are being considered. The MBTA will have some elements of an automated fare collection system implemented by 2003.

The MBTA is preparing to release a Request for Proposals to provide interactive travel information kiosks at the South Station Transportation Center (SSTC). These kiosks would provide a direct link to the MBTA's Web site where customers could access schedule information for all bus, rail, and boat service. New automatic trip planning functions are also likely to be added to the Web site during the next two years.

The MBTA is nearing completion of a request for proposals to provide an enhanced customer service information system. This system would be tied directly to the MBTA's new vehicle and driver scheduling software now being used by the Scheduling Department. This would allow customers to access next-trip information for all routes over the telephone or the Web. An itiner-

ary-planning tool would also be available to customers on the Web, generating origin-destination routing suggestions without the aid of a customer service agent. Other improvements would include TDD capabilities for all customer service agents, in order to reduce telephone-waiting time for persons with hearing impairments.

Bicycle Access

As part of the "Bikes on the T" program, permits are no longer required to bring bicycles on MBTA heavy rail and commuter rail trains. In the fall of 2000, bike racks were installed on 22 buses for use on Crosstown Routes CT1, CT2, and CT3. If successful, bicycle racks may be installed on other buses in the future. The MBTA has moved forward with plans to spend $50,000 in enhancement money to increase bicycle parking facilities at stations.

Reverse Commuting

The MBTA has initiated several new or enhanced bus services with access to jobs funding from the Federal Transit Administration. Service for reverse commuters is operated to Centennial Park in Peabody, Square One Mall in Saugus, Logan Airport, South Shore Mall in Braintree, business centers in Burlington and Bedford, and the Solomon Pond Mall in Marlborough. One of the important pieces of information that will be derived from the 2000 U.S. Census, once the data is available, is how commuting patterns have changed in the past decade. With better information, the MBTA can adapt its schedules and routes to better serve the changing nature of the region's commuters.

Service Evaluation Process

MBTA Operations is constantly monitoring service and trying to change or adjust service delivery according to the customer demand. The MBTA considers the following factors when considering service change requests:

- The rationale for the change
- Net cost per passenger
- Net cost per new passenger
- Existing and projected ridership
- The number of new transit riders
- Existing and projected operating costs
- Existing and projected fare revenue
- Added travel time for existing ridership
- Key characteristics and demographics of the market
- Contribution to the achievement of policy objectives
- Other factors as appropriate.

Requests for service changes and new services can be made by anyone-private citizens, elected officials, MBTA employees, or those representing neighborhood groups, business organizations, etc. Once received, they will be evaluated and reviewed by the Service Planning Department.

Park-and-Ride Facilities

Within the Boston Region MPO there are 117 park-and-ride facilities. These lots play an important role in reducing congestion in Boston's urban core by enabling individuals to drive short distances from their homes and gain access to other forms of transportation, such as commuter buses, carpools, and vanpools. Most of the lots are conveniently located in downtown centers or along major roadways.The MBTA, MassHighway, Massport, and Massachusetts Turnpike all operate park-and-ride facilities. The MBTA is by far the largest provider of commuter parking spaces.

A major constraint for the MBTA is the number of available parking spaces at park-and-ride facilities throughout the system and the limited amount of space available to expand these facilities. There are 76 commuter rail stations within the Boston region that have parking facilities. These lots typically charge $1 per day, although there are exceptions. There is a wide variance in the vehicle capacity of the commuter rail lots. Route 128 Station can currently hold 2,100 vehi-

cles, although 550 of these spaces are reserved for Amtrak passengers. Pride’s Crossing, Plimptonville, and Silver Hill stations all have spaces for fewer than 10 vehicles. The total number of spaces available at Boston region commuter rail stations in 2001 was 30,208.

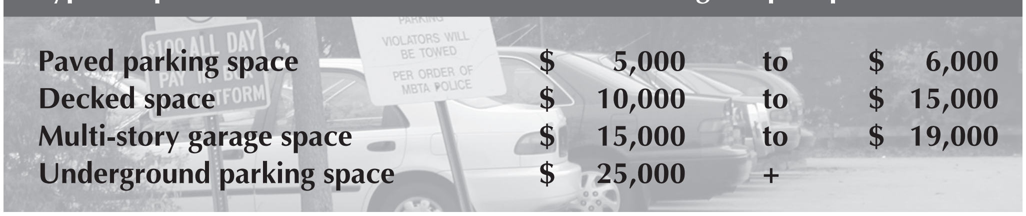
Of the 76 commuter rail park and ride lots, 60 were considered to be at capacity in 1999 according to the Congestion Management System’s (CMS) Park-and-Ride Lot Utilization Status report. The MBTA considers parking facilities to be at capacity when they are over 85% full. Most of the lots that were underutilized were smaller facilities with capacities of under 100 vehicles. The lone exception was Lynn, where the 965-vehicle facility (the commuter rail system’s second largest) was observed to be only 31% full. The excess space in Lynn is primarily due to its location in an urban downtown that is not well served by the highway network. Another problem is the early time at which many of these lots reach capacity. Although no studies have focused primarily on this situation, there is evidence in the form of comments from commuters that travel schedules and even work hours have to be shifted in order to arrive at commuter rail stations early enough to secure a parking space. Limited parking results not only in commuters being forced to drive into Boston when they find a commuter rail lot to be full, but also in some commuters forgoing transit altogether due to the uncertain availability of parking.

Several projects are either under construction or being planned to help remedy this parking shortage. The largest parking project is the result of the relocation of Mishawum Station in Woburn to the Anderson Regional Transportation Center site. This new station has a parking capacity of 2,400 vehicles, with some of this capacity being reserved for Logan Express bus service. The ongoing expansion of Route 128 Station will result in a total of 2,750 spaces, 550 of which will be reserved for long-term or Amtrak parking. The addition of three new stations in 2002 between Framingham and Worcester on the Framingham Line, will also increase parking. Two of the four stations, Ashland and Southborough, are located in the MPO region. These two stations will have a combined parking capacity of 1,150 vehicles. Another six parking expansion projects will add approximately 1,000 more spaces of parking. Most of the new spaces are the result of guidelines established by the Department of Environmental Protection in the State Implementation Plan requiring that 20,000 new intermodal commuter parking spaces were created before the end of 2000.

It is projected that even with these new additions, the commuter rail network will continue to have the majority of its park and ride lots at or above capacity. This problem is compounded by the increased difficulty of locating additional land around existing stations for parking expansion. Many stations are located in town or city centers where vacant land for expansion is scarce. Stations that are located outside of busy commercial districts are now attracting development themselves, complicating the expansion of these sites as well. Others are bounded by protected wetlands. It is also becoming increasingly difficult politically to expand existing stations, as the areas around many stations suffer from commuter rail-related traffic that originates from outside the town hosting the facility. Cost is another concern for the MBTA. The cost for each additional parking space can range from \$5,000 to \$20,000 per

TABLE 6-3
Construction Costs for MBTA Commuter Parking Spaces

Type of Space	Range ($ per space)		
Paved parking space	$ 5,000	to	$ 6,000
Decked space	$ 10,000	to	$ 15,000
Multi-story garage space	$ 15,000	to	$ 19,000
Underground parking space	$ 25,000	+	



Map 6-3
Park-and-Ride Lots

parking space. This figure does not include the cost of land acquisition.

The MBTA's rapid transit system is the location of another 29 park and ride lots. Ten of these are on the streetcar system (Green Line and Mattapan High Speed Line) and the rest are on the three heavy rail lines. Parking charges at rapid transit stations are typically $2.00 at surface lots and $2.50 at parking garages, Alewife Station is $4.00. The two largest parking facilities are on the Red Line. They are Quincy Adams (2,240 spaces), and Alewife (2,420 spaces). The total number of spaces on the rapid transit system is 15,626. All of these parking facilities were considered to be at capacity by the MBTA's 85% standard, with the exception of the four Mattapan High Speed Line stations. These four stations—Mattapan, Milton, Butler and Cedar Grove—account for only 314 spaces. Since almost all of the MBTA's rapid transit stations are in dense urban areas, the difficulties for parking expansion are even more acute there than for the commuter rail system. There are currently no significant parking expansion projects underway or planned.

The remaining 12 park and ride lots are Logan Express lots, MBTA bus facilities, MBTA-contracted ferry depots, or private bus and van lots. With the exception of the Massport-operated Logan Express lots in Braintree, Framingham, and Woburn (this lot will be relocated to Woburn Industriplex) and the Hingham ferry boat lot, these additional park and ride facilities are all well below capacity. The ferry depots with parking facilities are located in Hingham and at Pemberton Point in Hull. MassHighway owns park and ride facilities at 7 locations in the Boston Region MPO. These are located in Framingham, Rockland, Arlington, Milton, Pembroke, Canton, and Needham. Only the 450-vehicle facility in Rockland is at greater than 50% capacity.

One of the primary goals of the Regional Transportation Plan is to reduce congestion and VMT, and to improve air quality through an increase in the use of transit. Estimates of modal splits for the year 2025 suggest that this is a realistic goal, as significant increases in the demand for commuter rail are projected. But unless the current scarcity of parking availability at commuter rail stations is addressed, the system will not be able to live up to these expectations. The Boston Region MPO and the MBTA need to continue to work with municipalities to address the barriers to locating new parking facilities. Improved coordination with other regional transit authorities is needed. The MPO must also take a leadership role in identification of funding sources for parking facilities when space for them is found. But the commuting patterns in the Boston region today necessitate more than simply creating parking around radial transit lines. In order to reduce congestion, the Boston Region MPO must also work with MassHighway to encourage the use of existing underutilized park and ride facilities for carpooling, vanpooling and private bus commuters, not only for travel into the core, but throughout the region. As space at Logan Airport continues to grow scarce, the use of satellite facilities like those currently maintained by Massport must increase. The new Anderson Regional Transportation Center is an example of the type of coordination between agencies and modes that is crucial to the future of mobility in region. The Boston Region MPO needs to promote more integrated solutions like the Anderson Regional Transportation Center in the coming decades.

Conclusion

The past decade has seen an expansion of the commuter rail system with the opening of two of the Old Colony branches, the extension of the Ipswich branch to Newburyport and the extension of the Framingham commuter rail line to Worcester. In addition, almost 20,000 new parking spaces have been added to the commuter rail and rapid transit network.

The beginning of this decade sees the MBTA aggressively pursuing the concept of Bus Rapid Transit (BRT) with the three components of the Silver Line (South Boston Piers, Washington Street, and the New England Medical Center to South Station connection) and other future proposals.

The financial future of the MBTA is dramatically different from even a year ago. The General Court has provided a dedicated funding source to the MBTA and it must now operate within this source of funding as well as assessments to member communities and farebox revenue. This has required a detailed examination within the MBTA of its priorities and what capital expansion projects it can ably program.

The completed Blue Ribbon Panel study of the future of the MBTA concluded that capital expansion, while necessary to satisfy the transit demands of the region, must in the future take a back seat to maintenance of the existing system. This plan does not include a large list of new transit expansion projects. Instead it first looks at the maintenance needs of the existing system. Fully 70% of all available capital funds available to the MBTA is programmed for maintenance. Chapter 12 discusses future MBTA financial assumptions based on the MBTA Finance Plan submitted in association with the authority issuing its own bonds for the first time. This conservative set of assumptions has formed the basis for this Transportation Plan. As noted in Chapter 12, the MPO is planning to review the assumptions to see if it is reasonable to expect additional capital funds in the future.

As the model results in Chapter 11 show, demand for transit will grow over the next twenty-five years. The subway system will be experiencing dramatic growth, with the greatest challenge coming to the Red Line and the Green Line central subway. This growth also necessitates additional capacity for both the north and south-side commuter rail systems. According to the model projections, upwards of 20,000 new commuter rail parking spaces will be needed in Eastern Massachusetts and the bordering states to satisfy demand for increased ridership on the commuter rail network. Increased commuter rail rolling stock and new bi-level commuter rail cars will also be necessary to satisfy this demand.

A third area of need is providing more reliable and frequent bus service, whether it be in the suburbs by shuttles or some form of locally-subsidized bus, or in the core by MBTA bus. As we move into the future, demand for suburban transit service grows greater. This need may not be well-served by a radial network of Boston as the hub and the suburbs as the spokes. Projects best suited to further complement the existing transit system in the region requiring further exploration are the Urban Ring Transit system and the North-South Rail Link.

CHAPTER 7

BICYCLE AND PEDESTRIAN TRANSPORTATION

We are discussing two modes in this chapter that have some things in common and are also quite distinct. Pedestrians use sidewalks; bicyclists use streets. Pedestrian mobility is determined by whether there are sidewalks available, and their condition, and by the safety and convenience of roadway crossings. Bicycle mobility is affected primarily by road conditions, and in some respects, bicyclists have more in common with motorists than they have with pedestrians. Both modes use trails.

Why promote walking and bicycling? They do not require combustible fuels and do not pollute; they are quiet; they are healthy; they are the most economical modes for users, and facilities to support them are relatively inexpensive; they are available to all age groups, all socioeconomic strata; and they are, according to reliable sources, very enjoyable.

Legislative and policy leaders at both the national and state levels encourage bicycling and walking. The following are policy statements of the United States and Massachusetts governments, respectively.

> Bicyclists and pedestrians shall be given due consideration in the comprehensive transportation plans developed by each metropolitan planning organization and State… Bicycle transportation facilities and pedestrian walkways shall be considered, where appropriate, in conjunction with all new construction and reconstruction of transportation facilities, except where bicycle and pedestrian use are not permitted. (U.S. Department of Transportation, TEA 21 (Section 1202(a)(3)(1).)

> As we enter the 21st century, walking in Massachusetts will become a viable transportation choice for more trips: to work and school, for shopping, and for visiting friends and family. Increasing numbers of people throughout Massachusetts, residents and visitors alike, will be able to walk safely and conveniently to their destinations. Pedestrians, bicyclists, and drivers will be aware of each other's needs, and will act appropriately for the situation in which they are walking, riding, or driving. Walking will increase, while accidents involving pedestrians will decrease. Street and sidewalk design will accommodate and give greater priority to pedestrians in ways that are responsive to local

situations and needs. More people will be involved in their communities to improve conditions and encourage more walking.

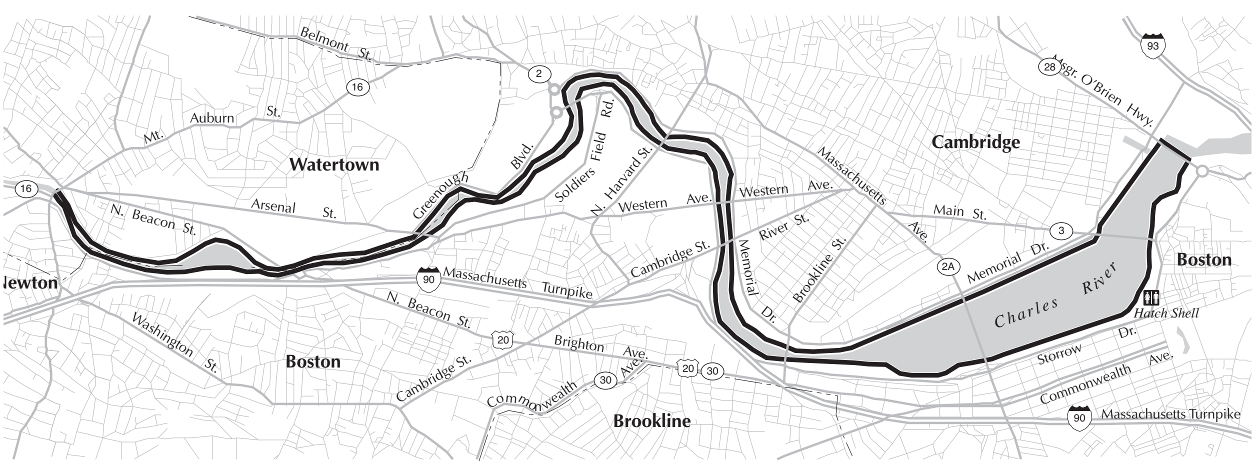
Physical improvements will be made to the pedestrian walkway system, encouraging more people to walk. More transit users will have the option to walk to and from local transit stops to more destinations with fewer conflicts and impediments. More malls and shopping centers will be more accessible to pedestrians, and town centers and downtown shopping districts will flourish. More walkers will know how to walk safely on rural roads, and learn how to share paths. More drivers and bicyclists will be aware of pedestrians and share roads and off-road facilities with them. More new development will occur in places that are within walking distance of activity centers to create increased opportunities for walking. (Massachusetts Pedestrian Plan, prepared for MassHighway by Wallace, Floyd, Associates, Inc., 1998, p 2-2.)

The vision of the Statewide Bicycle Transportation Plan is recognition of bicycling as a viable means of transportation and reasonable accommodation of the needs of bicyclists in policies, programs, and projects. Greater recognition and accommodation of the needs of bicyclists will lead to a more balanced transportation system with greater modal choice and improvements in bicycle safety. Such actions will enhance the environment and quality of life in the Commonwealth, and improve personal mobility.

Bicycling is also a highly efficient means of transportation as well as a healthy, enjoyable activity for people of all ages. (The Surgeon General has found that a regular, preferably daily, regimen of at least 30-45 minutes of brisk walking or bicycling can lead to improved health.) For all these reasons, bicycling should be encouraged and promoted so that more people will choose to bicycle. Improving facilities for bicycling will lead to greater use of bicycles and an increase in the attendant benefits to citizens, communities, and the Commonwealth." (Massachusetts Statewide Bicycle Transportation Plan, prepared for MassHighway by VHB, 1998, p. 3.)

How do we accomplish the above visions? We improve upon a transportation system that is already, in some places more than others, conducive to these modes. That means a comprehensive system that facilitates pedestrians and bicyclists going to both primary destinations and other modes. Ongoing efforts to improve conditions for bicycling and walking in the Boston Region MPO have been encouraged and bolstered by citizen involvement, especially through the Massachusetts Bicycle Coalition (MassBike) and Walk Boston.

MAP 7-1
Dr. Paul Dudley White Bike Path



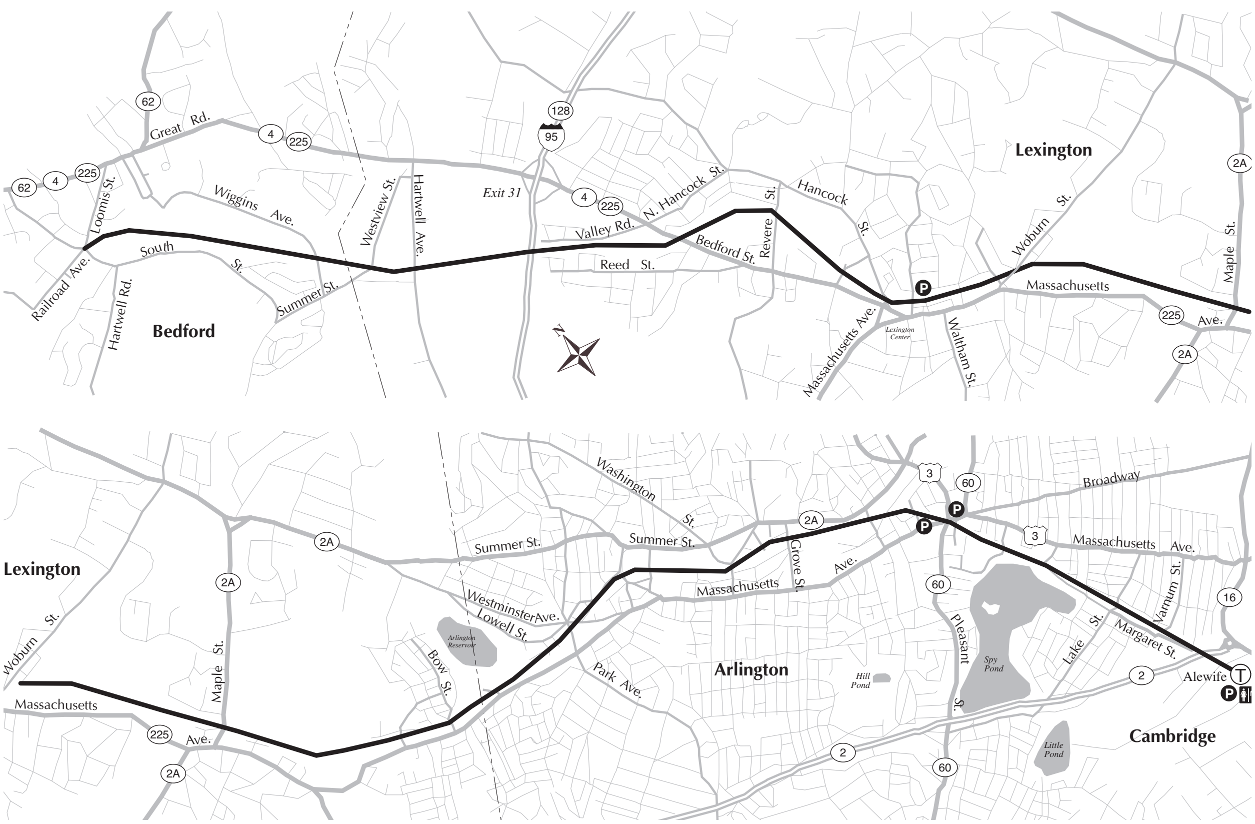
Education, Enforcement, Encouragement, Engineering

Issues related to bicycling and walking are often divided into the four E's of education, enforcement, encouragement, and engineering. The focus in this Transportation Plan is on engineering issues. Education, enforcement, and encouragement are also very important, however, and particularly so for these two modes. In the area of education, there is no formal requirement for pedestrians or bicyclists. At least motorists must reach a minimum age and pass a competency examination. The lack of education means bicyclists often do not know how to predictably and safely maneuver in traffic. A program called Effective Cycling, and offered through MassBike, goes beyond traditional bicycle education and teaches a bicyclist how to maneuver in traffic safely and predictably, and how to deal with emergency traffic situations. Likewise, motorists need to understand pedestrians' rights, and that bicyclists have rights that are equal to motorists on all but limited-access roadways.

Efforts have been made and need to continue to enforce traffic laws, as Cambridge has done. A lack of enforcement results in many bicyclists and pedestrians taking chances because of virtually no risk of tickets. Likewise, traffic enforcement to protect the rights of bicyclists and pedestrians is rarely a priority. More local police departments are using bicycle patrols, which is beneficial in that officers on bicycles experience firsthand the joys and challenges of that mode.

In regard to the fourth 'E,' encouragement, it is likely that some people reading this report have not bicycled since childhood. The bicycle is used as an important, often primary, mode of transportation in much of the rest of the world, including Europe. Americans often use motor vehicles for trips that could be made by foot or by bicycle. Bicycle or walk? We are not used to it, it seems like too much trouble, or it doesn't occur to us unless we're at the gym. No room at the com-

Map 7-2
Minuteman Commuter Bikeway



muter rail lot? Rather than bicycling (and then parking for free, space guaranteed), we drive all the way to work. Due to the "cold-start" phenomenon, motor vehicles pollute much more when cold than when they are warmed up. It would be much better for the environment if the shorter motor-vehicle trips to transit stations could be eliminated in favor of walking and bicycling.

Bicycle and Pedestrian Modal Shares

According to the 1990 journey-to-work U.S. Census data, about one percent of the residents in the Boston Region MPO bicycle to work. This U.S. Census estimate is considered low, for several reasons. First, the census does not include students, of which there are many in the Boston region. Second, the census surveys are conducted in March, a time of the year when bicycle ridership is relatively low. Third, people who use the bicycle once or twice a week, or who walk or bicycle to a transit stop, are not captured. Communities in which more than one percent of the population bicycle to work are Cambridge (3%), Somerville (2%), and Brookline (1.8%).

About seven percent of residents in the Boston Region MPO walk to work. No data for seasonal variations in walking are available for the Boston region. Communities with walk shares over ten percent are Cambridge (25%), Wenham (17%), Boston (14%), Wellesley (12%), Brookline (12%), and Somerville (11%). These data do not include those who walk to public transportation.

Dr. Paul Dudley White Bicycle Path

Trails

Trails are used by all non-motorized modes: bicyclists, walkers, skaters, joggers, and users of wheelchairs (which can be motorized) and baby carriages. Trails are used not only by experienced commuter bicyclists heading to work, but by novice adults and children, who, by using trails, might gain the confidence and experience necessary to travel on-road. Even with a significantly expanded network of trails in the Boston area, they can serve only a fraction of all trips.

Trails are usually built on railroad rights-of-way or along natural corridors such as rivers. Two major trails in the Boston Region MPO area are built along a river and rail, respectively.

- The Dr. Paul Dudley White Bicycle Path is located on both sides of the Charles River between the dam at the Museum of Science in Boston and Watertown Square. The MDC has extended a path on the north side of the river from Watertown Square to Waltham.
- The Minuteman Commuter Bikeway extends from the MBTA's Alewife Station in Cambridge through Arlington and Lexington to Bedford, on the MBTA's Bedford Branch. There is a linear park from Alewife Station to Davis Square in Somerville.

Other trails include the Muddy River Path (Brookline and Boston), the Southwest Corridor (paralleling the MBTA's Orange Line), Frederick Law Olmstead's Emerald Necklace, and MDC trail sections along the Mystic and Neponset Rivers.

Trails allow users to be separated from motor-vehicle traffic. Except at the intersections, the noise, fumes and collision-concerns associated with combustible engine vehicles are gone. While great care has to be taken at the intersections, the nature of most trails means there are fewer of them. For example, a traveler on the Charles River Path

needs to negotiate five intersections to go from the Museum of Science to Watertown Square. On the road system, that traveler would need to go through about forty intersections. Also, an on-road cyclist probably would pass hundreds of parked cars; the path cyclist might not have to pass any. The hazard of a parked car is the potential of a driver (or passenger on the driver side) opening the door unexpectedly in front of a passing cyclist. (This is an event which a well-trained cyclist would handle very differently than an untrained one).

A disadvantage of a trail is that it is generally slower for an experienced cyclist. The cyclist cannot go fast on the trail in consideration of slower users, and must yield at all crossings. Also, on trails a cyclist has to contend with dogs, leashed or unleashed, and the sometimes unpredictable movements of pedestrians and joggers. Bicyclists who travel too fast, pass too closely, or give no warning before passing make trail use uncomfortable for others.

In general, trails have proved to be very popular with a wide range of people. Proposed regional trails in the Boston area include the following (see Map 7-3):

- Bike-to-the-Sea (on the Saugus branch, from Lynn to Everett),
- the Tri-Town Bikeway (Winchester, Woburn, and Stoneham),
- Border to Boston (Newburyport branch and Eastern Route main line; Danvers to New Hampshire)
- Assabet River Rail Trail (Marlborough branch, to South Acton),
- Central Massachusetts (Berlin to Belmont, called the Wayside Trail),
- Lowell-Framingham (northern part is the Bruce Freedman Trail),
- Upper Charles (Framingham to Medway),
- Minuteman-Charles River connector (via the Watertown branch).

The MBTA has recently indicated that it will make rights-of-way available to communities for trails, either on a permanent or an interim basis, depending on whether the MBTA sees a potential future use of the land. (The Minuteman Bikeway, for example, is on MBTA land). There is also potential for trails alongside active rights-of-way, with appropriate safety measures, and these need to be examined on a case-by-case basis.

There is one major signed bicycle route in this region, the Claire Saltonstall Bikeway, between Boston and Cape Cod. Most of this route is on-road, with trail segments included where possible. This route was re-signed in 2000 by MassHighway.

Besides large regional facilities, there is also the potential for short trails to improve mobility and safety for walkers and bicyclists. A potential rail right-of-way connection in Wellesley to Riverside Station is an example of this type of improvement. Other possibilities occur where neighborhoods are cut off from each other because of the road layouts: to decrease through traffic, these neighborhoods end in cul-de-sacs. Short trails connecting these cul-de-sacs would allow only non-motorized access.

Road Travel

Improvements for bicyclists and pedestrians can be done during road reconstructions. Types of possible improvements include minor widening, especially in areas where a road narrows, new lane markings to favor a wider curb lane, dedicated bicycle lanes, new or improved sidewalks, and improved geometrics at intersections to facilitate bicycle travel and pedestrian crossings. Chapter 90E, Section 2A, of the General Laws (Chapter 87, Acts of 1996) requires consideration for bicycle and pedestrian traffic needs whenever feasible. (Section 2A: The Commissioner shall make reasonable provisions for the accommodation of bicycle and pedestrian planning, design, and construction, reconstruction or maintenance of any project undertaken by the department. Such provisions that are unreasonable shall include, but not be limited to, those which the Commissioner,

after appropriate review by the bicycle program coordinator, determine would be contrary to acceptable standards of public safety, degrade environmental quality or conflict with existing rights-of-way.)

The intent of this law is to make it as safe as practical for bicyclists and pedestrians. The intent of this law is not to widen every roadway in Massachusetts to two-twelve-foot lanes plus shoulders, taking trees, stone walls, and local character in its wake. In some circumstances, widened roads can encourage higher vehicular speeds, possibly contributing to less safe conditions for pedestrians and bicyclists. Part of the joy of bicycling or hiking in Massachusetts is finding those meandering local roads.

The most common on-road mobility constraint for bicyclists is lack of operating space. The law needs to be implemented with an eye to how an existing situation could be made better, given other constraints. Room for bicyclists can be provided by bicycle lanes, paved shoulders, by wide outside travel lanes. Cambridge has installed bicycle lanes, to denote areas of the roadway that are earmarked for bicycle use.

On a two-lane road, space can be taken from the travel lane and added to the shoulder by striping. On a four-lane road, space can be provided by reducing the width of the inside travel lanes and adding that to the outside travel lanes. According to the American Association of State Highway and Transportation Officials (AASHTO), an outside lane width greater than 12 feet (3.6m) better accommodates bicycles and motor vehicles, and recommends an outside-lane width of 14 feet, a width not commonly found in the metropolitan Boston area. For more information, see Guide for the Development of Bicycle Facilities, American Association of State Highway and Transportation Officials, 1999.

Pavement problems, including potholes, other pavement deterioration, especially at edges, and abrupt drop-offs at the edge of pavements, are much more critical to bicyclists than motorists because bicycles are single-track vehicles with relatively narrow tires. A particular problem is the substandard repaving often done after roads have been dug up for conduits or pipes; these excavations usually occur in the portion of the roadway used by bicyclists. Other problems include drainage grates with openings parallel to the road that catch bicycle tires; traffic-signal actuators that do not detect bicycles; and yellow lights that do not allow sufficient time for bicyclists to traverse an intersection.

Bicycle suitability maps and guides provide information to users and can help in planning future transportation projects. At both the regional and local levels, a map can help uncover areas where improvements are needed and where such improvements could make a large difference in bicyclists' ability to circulate. The following maps and guides have been printed and are available for purchase through local bicycle shops and bookstores:

- Boston's Bikemap (privately printed; inner metropolitan area)
- MetroWest Bicycle Map (publicly printed; thirteen communities west of Boston)
- Massachusetts Bicycle Guide (publicly printed; trail facilities, intermodal connections)
- Massachusetts Bicycle Map (privately printed; four maps covering the state).

An ongoing project at the Boston Region MPO is a comparison of the above MetroWest Bicycle Map ratings with the FHWA's index of bicycle compatibility. This project will use the FHWA model to rate the same roads that were rated subjectively by the MetroWest Bicycle Committee that produced the map.

One way to look at the issue of bicycle and pedestrian circulation is to ask if there are physical barriers to bicyclists, pedestrians, and other non-motorized travel. There are natural barriers such as rivers or lakes, where the expense of bridge or tunnel construction results in relatively few opportunities to cross. There are also man-made barriers, such as express highways or large

developments, that restrict bicycle or pedestrian access. There are also natural barriers such as snow that are exacerbated by man. Often snow is piled on sidewalks rather than removed from them, forcing pedestrians out into the street, where the width is already lessened, the road conditions may be poor, and at a time of year when more travel occurs during darkness. Going out of ones' way to get around these barriers requires more effort and time for a bicyclist than a motorist, and even more for a pedestrian. Second, the resultant crossing points often attract large volumes of traffic, sometimes becoming barriers themselves.

Safety Issues

Bicycling in traffic is relatively safe for those who know how. This would not be a controversial statement to experienced bicyclists, but probably is to those who never bicycle in traffic. Most transportation decisions are made by those who drive, and at least occasionally walk, but probably never or rarely bicycle. And yet it would be unimaginable to have our roadway system designed by people who do not drive.

The most experienced bicyclists do have fewer crashes. The importance of education, enforcement, and encouragement mentioned above need to be stressed. From an engineering point of view, how do we increase safety? One way to measure relative safety is to look at crash data. Even with limitations (incomplete location information and virtually all of the reported crashes concern collisions with motor vehicles and do not include falls), it is useful to determine the locations where large numbers of crashes occur.

An important question is why certain locations have higher numbers of crashes than others. Higher levels of motor-vehicle traffic, pedestrians, and/or bicyclists could be a factor. "Exposure rates" take these volumes into account and indicate the number of accidents per given level of traffic. If such rates were available, they would highlight areas that have particularly high numbers of crashes due to factors other than simply high levels of traffic.

Even without exposure rates, high crash locations ought to be studied to find out what design, operational, or enforcement steps need to be taken. Also, it is important to remember that a low number of reported crashes at a location is not necessarily an indication of safety. It may be an intersection that is perceived as particularly dangerous by bicyclists and pedestrians and avoided.

The five locations indicated in Figure 7-1 have the highest number of pedestrian crashes (1996-1998) in the Boston Region MPO. As stated above, all these crashes involve a motor vehicle.

Figure 7-1
Highest Pedestrian Crash Locations (from 1996 to 1998)

Community	Location	# Accidents
Brookline	Beacon @ Harvard	15
Boston	Airport Road	14
Framingham	Concord @ Waverly	8
Wellesley	Cameron @ Washington	8
Quincy	Beale @ Hancock	6

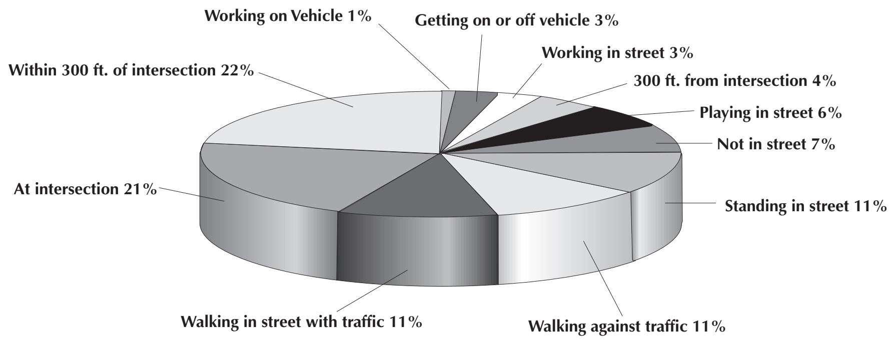
As shown in Figure 7-2, about a fifth of pedestrian crashes (statewide, in 1995) occurred at intersections, with another fifth within 300 feet of an intersection. About another fifth occurred walking in the street, about half against traffic and half walking with traffic. It is not known whether or not there were sidewalks.

There are many locations in the Boston Region MPO without sidewalks on either side of the road. Some believe that unless pedestrian volumes are high, sidewalks are not necessary. On the other hand, we build roads that carry low volumes of traffic simply to provide access. With the

same criterion applied to pedestrians, a sidewalk is required anywhere where pedestrians need to be accommodated. If volumes are expected to be low, than a facility could be placed on one side only, with crossings provided as necessary.

There are no “top five” locations for bicycle crashes. Figure 7-3 indicates the eleven locations with three or more bicycle accidents. Six locations in Cambridge have between five and eight crashes, and the remaining locations have between three and four. (There are undoubtedly other locations that would be in these lists if better information were available.)

FIGURE 7-2
Location of Pedestrian at Time of Accident (Massachusetts)



Note: Sample includes all accidents involving pedestrians where location of pedestrian was indicated. Location was not reported for 46 % of the accidents.
Source: Highway Management System, Massachusetts Highway Department/ Registry of Motor Vehicles, 1995.

FIGURE 7-3
Highest Bicycle Crash Locations (from 1996 to 1998)

Community	Location	# Accidents
Cambridge	Broadway @ Prospect	8
	Mass. Ave. @ Memorial Dr.	7
	Amherst @ Mass. Ave.	6
	Columbia @ Hampshire	6
	Mass Ave. @ Pearl	6
	Mass Ave. @ Walden	5
Salem	Lafayette @ Ocean Ave	4
Framingham	Concord @ Waverly	4
Boston	Charlesgate West @ Storrow	4
Brookline	Beacon @ Washington	4
Boston	Old Colony @ Preble	3

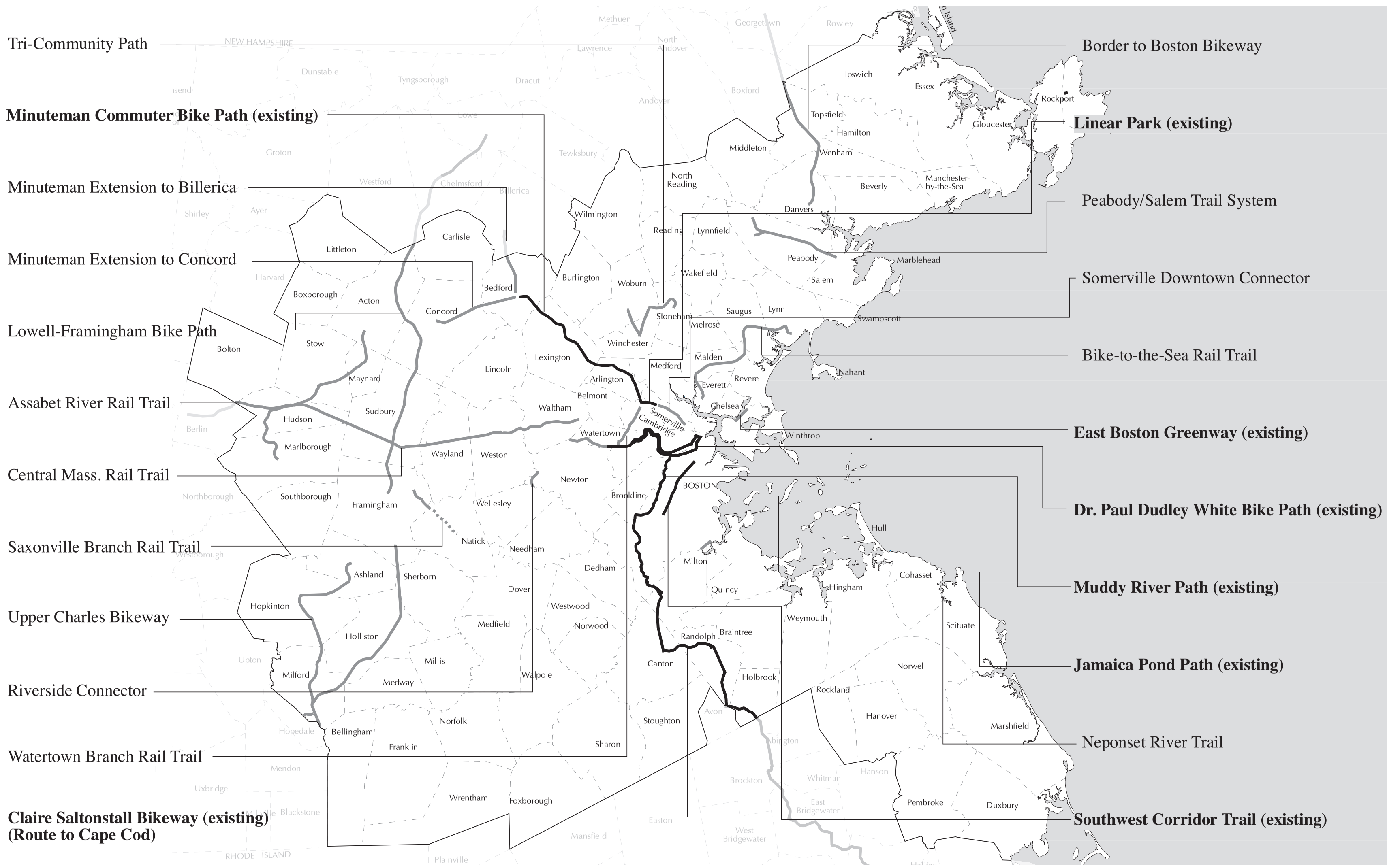
ACCESS TO OTHER MODES

Because bicycling and walking are most popular for trips under five miles and one mile respectively, they are used often to connect to other modes. Those who bicycle to the transit connection either park their bicycle or take it on board. There are parking facilities at most MBTA stations, and they are added as a matter of course during station reconstructions. The parking facilities are racks, although there are now bicycle lockers available at the South Acton station on the Fitchburg/South Acton commuter rail line and Salem on the Rockport line. Important issues to consider in locating bicycle parking are security, accessibility, and protection from weather.

The hours of bicycle access onto the three rapid transit lines (no access on the Green Line) include all day Saturday and Sunday, midday (10 A.M. to 2 P.M.) during the week, and week nights after 7:30 P.M. Bicycles are allowed on all off-peak commuter rail trips. There is no additional fee for the bicycle. The MBTA eliminated the need for a bicycle pass in October 2000 on a three-year experimental basis and for the first time provided racks on MBTA buses (Crosstown routes). The rack on the front of the bus accommodates two bicycles.

Access on private buses is a matter of company policy. On the private carriers, the bicycle would be stowed in the baggage compartment. Bicycles

Map 7-3
Existing and Proposed Bicycle Facilities



are also allowed on the ferries serving Boston Harbor. Some ferry companies charge a fee.

Improving access to and allowing bicycles on other modes can increase ridership on these modes. Take commuter rail as an example. Most commuter rail parking lots are full early in the morning. Someone bicycling to the station can arrive at any hour and park. Compared to walking, the bicycle increases the distance one can travel in a given amount of time. Someone who lives too far to walk to a station might consider bicycling. Likewise, the trip on the other end might be too long for walking, or inconvenient for transit, but possible by bicycle. During times of congested motor-vehicle traffic, the bicycle is often a quicker mode for trips up to a few miles.

TRAFFIC CALMING

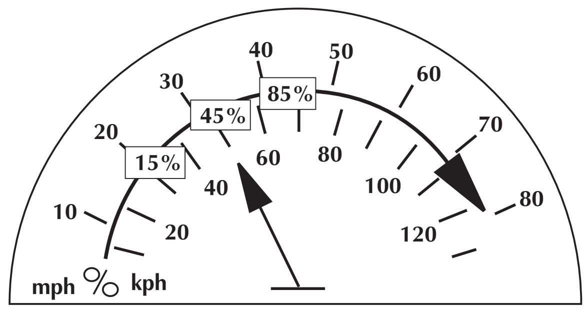
The term traffic calming is used to denote a variety of measures to make streets safer for all users – motorists, and those on foot and bicycle. Slowing down motor vehicles reduces the chances of collisions. And if a collision occurs, the slower the speed of the motor vehicle, the less severe the damage to the bicyclist or pedestrian (see Figure 7-4).

The City of Cambridge has been active in the area of traffic calming. Raised crosswalks and intersections have been installed in selected areas, with pavement markings and changes in surface materials, to warn and slow motorists. There are measures which are technically pedestrian improvements that also have a traffic calming effect. Many communities have placed YIELD TO PEDS IN CROSSWALK signs in the middle of crosswalks to reinforce the law. Cambridge, Boston, and Wellesley have installed traffic signals that show, instead of the flashing DON'T WALK sign, a countdown of the number of seconds remaining to cross.

Other measures include safety islands, so pedestrians can have a refuge when crossing wide streets; and curb extensions, which increase the visibility of the crossing area, reduce the distance the pedestrian must travel to cross the road, and decrease the speed of motor vehicles. The targeted enforcement of motorists regarding pedestrian safety, as the Boston Police Department did this summer, is another example of tools that complement traffic calming.

It is worth stressing that these traffic calming measures are not only to increase the safety of an area, but also to make an area more pleasant for those living and working there. It is a group of measures that puts the emphasis on being in a place, not getting through it.

FIGURE 7-4
Chance of Pedestrian Fatality



Source: "Killing Speed and Saving Lives," United Kingdom Dept. of Transportation

CONCLUSION

The Boston Region MPO should build upon the steps that have already been taken to improve the transportation network for bicyclists and pedestrians. MassHighway, in conjunction with local communities, should make new and reconstructed roads as safe as practicable for bicyclists and walkers. This could include narrower travel lanes that would have the effect of slowing through traffic, allowing more shoulder room for bicyclists, and more buffer space for pedestrians. All roads that would attract any pedestrian traffic also need provisions for pedestrians on at least one side of the road. Trails have proved to be very popular with both bicyclists and pedestrians. Relevant agencies need to resolve right-of-way and funding issues so that locations for new trails can be identified and so that the regional proposals that have been recommended through feasibility studies (Central Massachusetts, Assabet River, Watertown Branch, Upper Charles, Border to

Boston) and the extensions of the Dr. Paul Dudley White and Minuteman Paths can move forward. By siting bicycle racks in covered areas and by providing lockers, bicycle parking can become more secure and convenient for users. Improved facilities for bicyclists at transit stations, airports and ferry terminals are other important investments. Advisory boards for both bicycle transportation and pedestrian transportation need to be established under Executive Office of Transportation and Construction (EOTC.)

CHAPTER 8

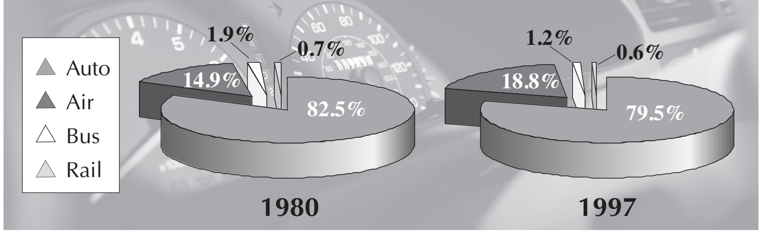
INTERCITY TRAVEL

The importance of passenger travel between cities is particularly acute in the densely populated New England and Northeast Corridor regions. The Boston region is the largest urbanized area in the six-state New England region. As such, it is of significance to intercity travel in New England both as the major trip generator and as the transportation hub for many trips in which Boston is not the point of origination or destination. Based on 2001 figures, Boston's Logan International Airport carries approximately 58% of all commercial air passenger trips that pass through the New England passenger airports studied in this report, although the Boston area's population comprises only about 25% of the six states' total.

The Boston region is also the northernmost major metropolitan area in the Northeast Corridor. This corridor, which encompasses Washington, D.C., Baltimore, Philadelphia, New York City, Boston and the smaller urban areas in between, has historically generated more intercity travel than any other region of the nation. Even as the population of the United States has dispersed to the south and west, the size and proximity of its cities to one another has kept the Northeast Corridor as the nation's largest generator of intercity traffic.

Figure 8-1
Domestic Intercity Passenger Miles by Mode
(Billions of Passenger Miles)

Mode	1980	1990	1997
Auto	1210	1639	1968
Air	219	359	465
Bus	27	23	30
Rail	11	13	14
Total Miles	1468	2034	2476



Boston's location at the northern end of this corridor has led to its being a termi-

nus for most of the intercity bus and rail traffic coming through the region from New York City and points south. Boston's proximity to New York City, the nation's largest metropolitan area, has created a situation where air, bus, and rail frequencies between the two cities surpass the levels seen in almost every other city pair in the United States outside of the Northeast Corridor. Automobile traffic on the major highway routes heading south along the corridor is also greater than that observed on other intercity highways between metropolitan areas outside of the region.

As the region's roads and airports continue to grow more congested, the development of a regional strategy that provides travelers with a variety of options becomes imperative. This strategy must take a multimodal approach that also addresses the constantly evolving needs facing today's traveler. Important steps have already been taken by the Boston Region MPO. The new South Station Intermodal center provides the types of seamless intermodal connections necessary to attract travelers to transit. The resulting increase in intercity bus travel demonstrates the effectiveness of this investment. Implementation of the Fast Lane program on the Massachusetts Turnpike and the bridges and tunnels of Boston have aided the Commonwealth in collecting needed revenue without increasing congestion and delays for the region's highway users. And efforts by the Massachusetts Port Authority to partner with competitors in an effort to efficiently distribute the demand for air travel throughout the region have already created benefits in the form of increased choice for the region's travelers. A continuation of efforts such as these is the key to maintaining the viability of the regional travel network.

Regional Airport Network

The introduction of low-cost airlines, such as Southwest, MetroJet and Shuttle America, into the Northeast and their use of traditionally smaller regional airports has changed the dynamics of air passenger travel for New England. Although Logan International Airport carries the vast majority of the Boston region's passenger air traffic, events over the past five years have shifted most of the growth in air passenger travel to other regional airports.

Over the past three years there has been a 22% increase in passengers served by the regional airports of New England. In contrast, passenger activity at Logan Airport grew by only 8%. This increase has come mostly at the newly expanding airports of Manchester, New Hampshire and T. F. Green, Warwick, Rhode Island. For purposes of this discussion, Bradley Airport, Hartford, Connecticut, was not included in this discussion due to its distance from Boston.

Figure 8-2
2001 Passenger Activity at New England Regional Airports and Logan Airport[1]

Airport	Passengers (in millions)	Percent of Total	Change from 1999
Logan Airport	**24.06**	**57.9%**	**-11%**
Hartford Bradley, CT	**7.30**	**17.6%**	**4%**
T.F. Green, Warwick, RI	**5.53**	**13.3%**	**8%**
Manchester, NH	**3.16**	**7.6%**	**13%**
Portland, ME	**1.25**	**3.0%**	**-9%**
Worcester, MA	**0.13**	**0.3%**	**225%**
Hanscom, MA	**0.14**	**0.3%**	**600%**
TOTAL	**41.57**	**100.0%**	**-3%**

[1] Regional airports in Bangor, ME, Burlington, VT, New Haven, CT, and New Bedford, MA were excluded due to their small market share and lack of influence on Boston travelers' decision-making process.

Note: Commercial flights began operation from Hanscom in 1998.

Map 8-1
Intercity Travel

Logan Airport

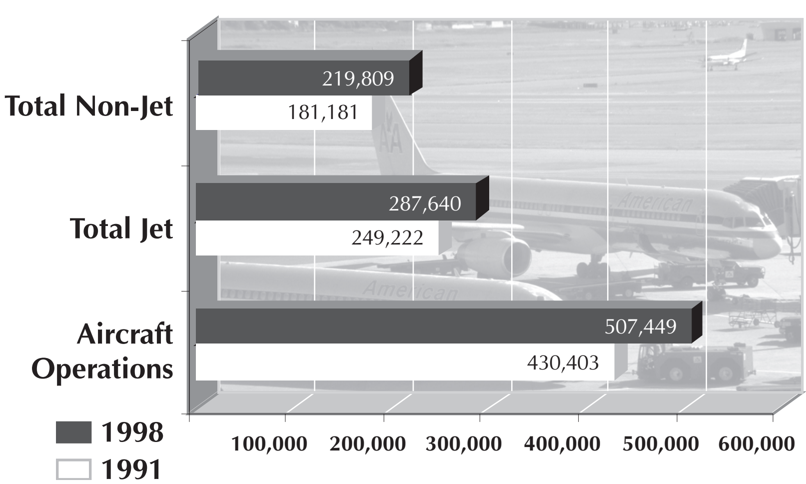
Boston's Logan International Airport, located in East Boston, is by far the largest passenger airport in New England. The facility is owned and operated by the Massachusetts Port Authority (Massport). Logan's 454,625 aircraft operations in 2001 ranked it the 6th busiest airport in the United States. The vast majority of these operations, 97.8%, were passenger aircraft operations. In terms of passenger volume, Logan is the 18th busiest facility in the United States, and the 29th busiest in the world. Logan served 27 million passengers in 1999, a 2% increase over 1998.

Logan's passengers have 63 regional, national, and international airlines to choose from, providing direct service to more than 100 airports in the United States and abroad. New York City is by far the most popular destination for planes departing Logan, with over 30,000 of 1998's total of 233,411 passenger departures bound for the nation's largest city. Washington, Philadelphia and Chicago were other popular destinations as

each generated more than 10,000 departing flights in 1998. Over 15% of the passengers served by Logan were on international flights. International growth from 1998 to 1999 was 7.7%, a considerably faster rate of growth than in the domestic market.

Access to Logan Airport is greatly facilitated by its location less than two miles from downtown Boston. Air passengers can choose from a wide range of private and public modes and services when travelling to the airport. Logan Airport ranks behind only San Francisco in the U.S. in terms of the percentage of air passengers using public transit for their trip to the airport. Approximately 18.6% of those traveling to or from Logan use public transportation to get there. 2.9 million of these travelers access the airport via the MBTA's Blue Line rapid transit service. Massport provides free shuttle bus service between Airport Station on the Blue Line and all airport terminals.

FIGURE 8-3
1991–1998 Aircraft Operations at Logan



In addition to the Blue Line, the MBTA offers connections to Logan on the CT3 bus route, as well as on several North Shore bus routes originating in downtown. Logan Express, operated by Massport, provides park and ride connections from suburban terminals in Woburn, Braintree, and Framingham. This service attracts over one million passengers per year. Water shuttle service from Rowes Wharf, Quincy, and Hingham is available along with private water taxis from several other locations. Taxi service provides another alternative to driving to Logan. In 1999, about 1.96 million taxis were dispatched from Logan carrying arriving passengers.

Automobile trips account for the majority of the remaining trips in and out of Logan Airport. Since 1991, the Massachusetts Department of Environmental Protection has enforced a parking freeze at Logan which caps the number of total spaces at 20,692.

Of those spots, 15,467 are reserved for commercial use (primarily air passengers) and the rest are allotted to airport employees. The majority of commercial spots are used for short term parking. Of the 3.4 million parking exits in 2000, 2.2 million were for automobiles that had been parked for less than four hours.

Improvements to alternatives to Logan over the next few years will divert some of the passenger traffic growth away from the airport. Smaller regional airports in New England have grown from carrying 30% of the passenger market in 1995 to 39% in 1999. This growth is expected to continue, and by 2010 it is projected that an additional 3.4 million passengers will be diverted from Logan to these regional airports. Rail projects like Amtrak's high-speed rail, and service to Portland are projected to divert another 1.22 million passengers annually from shorter Logan Airport flights.

Investments in access to Logan Airport will help the facility serve the growing number of air passengers expected in the upcoming decade. The ability for Logan to grow to meet its expected demand of 34 million by 2010 and to 37.5 million passengers per year by 2015, is becoming increasingly strained by delays at the airport. Recent forecasts of growth for Logan are lower than past years due to the growth of other regional airports serving the Greater Boston market. The FAA currently ranks Logan as the 7th most delayed airport in the

nation based upon average delay per operation. In 1998, there were 143,000 total hours of aircraft runway and taxiway delays.

Delays at Logan Airport primarily result from three causes. Two of these causes are due to the number and alignment of Logan's runways. The airport has five runways, of which four are capable of handling large aircraft. Of these four, only three can be used concurrently. During times of strong northwest winds, occurring approximately one-third of the time at Logan, the number of operational runways is often reduced to two and sometimes one. This reduction in capacity is one reason for delays. This condition also creates a situation where smaller aircraft are forced to share runways with larger planes. The FAA requires greater distance between large and small aircraft during take-off and landing. Finally, airline over-scheduling at certain peak times presents a third area of potential concern for delays. Although this has not been a problem at Logan in recent years, projections for travel demand at the facility in 2010 would likely result in an inability for the current runways to keep up with demand.

Logan Airport

Logan Airport Modernization Projects

In February 1999, Massport filed a Draft Environmental Impact Statement outlining its proposal to eliminate the problem of delays at Logan. Massport's solution combines improvements to Logan's taxiway system, a new centerfield taxiway and the construction of a new unidirectional runway, known as 14/32. The combination of these improvements is projected to decrease the number of delay hours in 2010 by 105,100 to 160,700 hours, depending on the actual increase in air passengers. The new runway's alignment itself would eliminate the delays created by strong northwest winds and the need for small and large aircraft to share runways. The runway would be responsible for 61,000 to 94,000 hours of the delay reductions. Massport received a MEPA certificate for the Logan Airside Improvement Planning Project on June 15, 2001.

A major environmental issue associated with the proposed Logan Airport runway is the question of added environmental burden placed upon the residents along the flights paths from Logan. Residents of Boston and its surrounding communities bear the burden of noise pollution from overhead flights.

Massport maintains that the construction and operation of 14/32 would allow for a better distribution of over flights than today. Communities north and south of Logan Airport would benefit from significant reductions. Runway 14/32 would shift approximately 25,000 flights annually from over the land to over the water.

Several projects directed at improving access to Logan have been completed recently, or are in the process of construction or planning. In 1998, the West Garage opened consolidating 3,150 parking spaces under one roof, while an equal number of surface parking spaces were eliminated. Access from this new garage, as well as Central Parking, is being improved through new pedestrian walkways to terminals A, B, C, and E. Terminals B, C, and E are also being improved through renovation projects, while Terminal A is to be completely rebuilt over the next 3 years. The work at Terminal B involves the consolidation of American Airlines' domestic, international, American Eagle, and Business Express services. In order for Amer-

ican's international arrivals to be able to use Terminal B, Massport is building a new satellite Federal Inspection Services Facility (FIS). The only FIS at Logan at this time is at Terminal E. The new FIS will reduce the need for shuttles transporting passengers transferring between international and domestic flights, as well as the need for aircraft to be towed between terminals. American will also invest in improvements to ticketing areas, baggage handling facilities, concessions, and circulation at Terminal B. Terminal E renovations are scheduled to be complete in 2003 and include the construction of a double-deck access ramp to reduce curbside congestion. Space will also be added for ticketing, customs, and the existing FIS. Delta Airlines will be the primary carrier at the new Terminal A and their gates will be closer together than they are currently at Terminal C. The new terminal will have 25 aircraft boarding positions. Of these, 18 are aircraft gates and 7 are apron parking positions. The current Terminal A has 26 boarding positions, but only 12 of those are aircraft gates. Part of the new facility will also serve as an improved noise barrier between the airport and the Jeffries Point neighborhood of East Boston. As part of Delta's environmental mitigation for the new terminal, the airline's entire ground service fleet will be converted to alternative fuels by 2008. Improved transit access to the airport is also being planned. A rebuilt Airport MBTA station and better connections with South Station via the South Boston Piers Transitway through the Airport Intermodal Transit Connector are two of the current projects that are designed to increase public transportation's share of the Logan air passenger market.

T. F. Green Airport

Located in Warwick, Rhode Island, T.F. Green Airport is the primary airport for the Providence metropolitan area in addition to annually serving over a million passengers from the Boston metropolitan area. Over 200 flights per day pass through Green Airport. Sixteen airlines serve the facility providing flights for all major U.S. carriers except TWA and America West. Nonstop travel is offered between Green and 28 U.S. and Canadian destinations. New York, Chicago, Houston, Toronto, and Washington are among those cities served. These flights carried over 5 million passengers in 2000. The airport is located 60 miles south of downtown Boston. The State of Rhode Island and the MBTA have reached an agreement to extend the Providence commuter rail line south to T.F. Green Airport. As part of the arrangement, Rhode Island will pay for two commuter rail engines to be dedicated to the Providence line. Service on this extension is projected for 2005. Frequencies have already been increased between South Station and downtown Providence and a layover facility is being relocated from Attleboro to Pawtucket, Rhode Island as part of the agreement. Currently, the Rhode Island Public Transit Authority provides local bus service to T.F. Green from a location four blocks from the Providence train station. Bonanza Bus Lines currently provides 18 daily trips from South Station to the airport. The bus trip is 90 minutes long. Passengers driving from the Boston metropolitan area primarily use I-95 and have a choice of valet, garage, or long-term lot parking at Green airport. T.F. Green Airport has seen its annual passenger count more than double in the past five years. It is currently one of the fastest growing airports in the nation.

Manchester Airport

Manchester Airport is located 55 miles north of Boston in New Hampshire's largest city. It is the largest airport in New Hampshire and serves a growing segment of the Boston market. Also one of the nation's fastest growing airports in recent years, Manchester has seen its number of daily flights increase to 75 and the number of passengers increase to over 3.1 million in 2001. All major U.S. airlines provide service from Manchester except TWA, American, and America West. Daily nonstop flights are available between Manchester and 14 North American cities including New York, Chicago, Philadelphia, Detroit and Washington. Bus service to Manchester Airport from South Station is provided four times daily by Vermont Transit with travel time of 90 minutes. Both I-93 and Rt. 3 provide access to those

driving from the Boston metropolitan area to Manchester. The airport has both a short-term parking garage and long-term lots. Manchester Airport is the third largest cargo airport in New England after Logan Airport and Bradley Airport in Connecticut. UPS and FedEx are two of the six cargo airlines serving Manchester.

Worcester Airport

Worcester Airport is 48 miles west of Boston in Massachusetts' second largest city. 1.3 million people live within 30 miles of Worcester Airport. Although the airport served 360,000 passengers as recently as the late 1980s, that figure had fallen to 77,000 annual passengers by 1998. The Massachusetts Port Authority has taken over the operations of the facility, and hopes to attract more airlines and passengers. There is no direct access to the airport from I-90 or I-290 and local Worcester streets need to be used to reach the facility. There is currently no direct bus access to the airport from Boston, although transfers can be made from downtown Worcester on Worcester Regional Transit Authority local buses. Currently, U.S. Airways Express offers up to four daily flights to Philadelphia, Delta Airlines flies three times daily to Atlanta and American Airlines has three flights daily to JFK International Airport. Daily non-stop service to Orlando/Sanford Airport in Florida is provided by Pan Am. In July 2001, American Eagle began twice daily flights to Chicago O'Hare Airport. Worcester is projected by Massport to attract from 600,000 to 800,000 passengers by 2010. Projected destinations include Atlanta, Philadelphia, Washington, D.C., New York, Chicago, Newark, Orlando, Pittsburgh and Cincinnati.

Hanscom Field

Hanscom Field is located in the towns of Bedford, Concord, and Lexington, 15 miles northwest of downtown Boston. It has been owned and operated by Massport since 1974. It is the busiest general aviation airport in New England, handling 197,302 operations in 1999. Its business, charter, private and air taxi flights carry approximately 101,000 passengers annually. Only one commercial carrier serves Hanscom. Shuttle America offers ten daily round trips to Trenton, New Jersey Greensboro, North Carolina and Buffalo, New York. In the fall of 2000, Shuttle America began service between Hanscom and LaGuardia Airport in New York City. The new service consists of five daily round-trips, with reduced service on the weekends. Massport hopes that this new service will help reduce the demand for shuttle flights out of Logan Airport. Located only one mile from I-95 and Rt. 128, it is easily accessible by car and free parking is provided. Public transportation access is provided on the MBTA's 76 bus route out of Alewife Station.

Pease International Tradeport

Pease International is located in Portsmouth, New Hampshire. Pease is a former U.S. Navy and Air Force base that was converted to a passenger facility in 1991. In addition to charter flights, the Tradeport has recently begun to offer scheduled commercial flights. Currently, the only airline to serve Pease is Pan American Airways, whose headquarters are also at the Tradeport. There is one round trip per day between the Tradeport and Bangor, Maine; Allentown, Pennsylvania; and Orlando/Sanford, Florida. Portsmouth and the Tradeport are located 50 miles north of Boston. Pease is easily accessible by car from I-95. C&J Trailways provides direct bus service from South Station to Pease 14 times per day with a travel time of 90 minutes.

Intercity Rail

Amtrak

Amtrak, the nation's passenger rail system, offers 19 daily departures from South Station in downtown Boston. Amtrak shares the rail facility with the MBTA's commuter rail service and is adjacent to the South Station Red Line subway station and recently constructed intercity bus terminal. Seventeen of the departures operate along the Northeast Corridor route which provides direct service to Providence, New Haven, New York City,

Philadelphia, Baltimore and Washington, D.C. Service along this corridor makes additional Boston stops at Back Bay Station and the Route 128 Station in Westwood. A total of 550 long-term parking spaces are available at the Route 128 Station for $10 per day. No long-term dedicated parking is provided at South Station or Back Bay. The other intercity rail destination is to Chicago via Springfield with intermediate stops in Back Bay, Framingham and Worcester.

Annual ridership out of South Station in 2000 was 905,580. Annual ridership for the other stations is as follows: Back Bay 131,970, Route 128 Station 181,291 and Framingham 6,208.

Beginning in January 2000, Amtrak began a modified high speed rail service along the Boston to New York corridor. This new train, Acela Regional, initially reduced the travel time from central city to central city to 4 hours. In December of 2000, Amtrak began regular Acela service, with travel times of 3 hours and 27 minutes between Boston and New York. This service between Washington, D.C. and Boston constitutes the only high-speed rail service in the United States. The train can achieve speeds as high as 160 miles per hour with a travel time from Boston to New York of 3 hours, 5 minutes. Amtrak hopes that its service will rival air traffic and that a portion of the business travel market will shift from air to rail.

Acela high-speed rail

Travel times on Acela are competitive with air because Acela has stops at South Station, Route 128 and Penn Station in New York City. The business traveler will not have to allocate time at each end of the trip to get to and from the airport but will instead use a convenient downtown or beltway station. Commuting from the central business districts of Boston and New York to the respective airports at each end can add as much as an hour each way to a trip.

In December 2001, Amtrak re-instituted passenger rail service from Boston to Portland, Maine. The 2 hour and 30 minute travel time from Boston's North Station to downtown Portland includes station stops in Haverhill; Exeter, Dover, and Durham, New Hampshire; and Wells, Saco, and Old Orchard Beach, Maine. This service has become quite popular, and is the only intercity passenger rail service north of Boston.

In addition to the Acela service along the Northeast Corridor, two additional New England rail corridors have been designated by DOT as high-speed rail corridors. The first is the new service between Boston and Portland, Maine. The second corridor runs from Boston (North Station) to Burlington, Vermont. This line would serve Lowell; Nashua, Manchester and Concord, New Hampshire; and Montpelier, Vermont. The line could potentially extend through St. Albans, Vermont to Montreal, Quebec.

A proposal for the connection of North Station and South Station is under study by the MBTA. This would provide a connection for Amtrak service as well as MBTA commuter rail.

Commuter Rail

The MBTA's commuter rail system provides service to other New England cities, although these trips are primarily scheduled to coincide with commuting patterns into Boston. The largest cities served by the commuter rail system are Providence and Worcester from South Station, and Lowell from North Station. The MBTA

recently participated in efforts by the New Hampshire Department of Transportation to extend commuter rail service to Nashua, New Hampshire and potentially Manchester, New Hampshire. The project to extend the commuter rail service 11 miles from Lowell to Nashua has received a $16 million federal earmark in FY 2000 FTA New Starts funding, of which $1 million is now being used to contract for preliminary engineering, design and permitting work. An extension of the Haverhill commuter rail line to Plaistow, New Hampshire is being pursued by that state.

INTERCITY BUS

The vast majority of intercity bus trips that serve the Boston metropolitan area use the South Station bus terminal as their Boston passenger facility. The terminal is adjacent to the South Station rail terminal and subway station. On an average day, 12,000 passengers pass through the bus terminal. Although some of this travel is suburban commuter trips, most of it is longer intercity travel. This market is served by several companies with Greyhound, Peter Pan and Bonanza having the largest number of daily arrivals and departures. Between Greyhound and Peter Pan there are departures to New York City every 15 minutes throughout most of the day. Direct service to most major cities and attractions within New England are available, as is service to Montreal and Toronto. Since its completion in 1995, the number of buses using the facility has increased to the point where consideration is being given to adding an additional level.

Intercity bus

AUTOMOBILE

By far the largest share of intercity travel is by automobile. Nationally, almost 80% of all intercity passenger miles are traveled by use of the automobile. The automobile offers the convenience of traveling at a driver's discretion, the immediate incremental cost of travel is relatively low and the driver has more freedom to divert from a schedule. These are all the same reasons that a large percentage of personal local trips are made by automobile.

I-95

Interstate 95 provides the only direct highway connection to New York City from the Boston metropolitan area. Between Boston and New York, I-95 also serves Providence, Rhode Island and New Haven, Connecticut. I-95 continues south through the corridor to serve Philadelphia, Baltimore and Washington, D.C. Although I-95 does not pass directly through Boston, access to the highway is provided on Interstates 93 and 90. The distance to New York City from downtown Boston on this route is 229 miles. To the north of Boston, I-95 serves Portland, Maine.

I-90 (Massachusetts Turnpike)

The Massachusetts Turnpike provides an alternate route to New York City and the rest of the Northeast Corridor from Boston. The primary variation of this route involves taking the Turnpike to Sturbridge, and then using Interstates 84 and 91 to connect with I-95 in southern Connecticut. It is 225 miles to New York City via this route. The Turnpike charges a $2.65 toll to travel from

Boston to Sturbridge. The Turnpike is also the fastest route to Worcester and Springfield.

The following chart shows a comparison of ways to travel between Boston and New York City. The costs and distances are for one-way travel. The largest percentage of trips between the two city pairs is by automobile. One reason is the convenience of travel on demand afforded by a personal automobile and the fact that most of the cost of automobile use is a fixed cost already absorbed by the consumer with the purchase and upkeep of the vehicle.

FIGURE 8-4
Intercity Travel between Boston and New York by Mode

Mode	Cost[1]	Frequency[2]	Travel Time[3]
Auto	$93	N/A	4 Hours
Air	$65	30 Minutes	1 Hour
Bus	$33	15 Minutes	4 Hours
Rail	$50	90 Minutes	4 Hours

[1] Cost is one way based on the purchase of a round trip ticket. For automobile travel, the price was determined by using Federal Highway Administration estimates on the cost of owning and operating automobiles per mile (41¢ per mile), multiplying this figure by 212 miles, and adding current toll expenses.

[2] Frequency is based on weekday daytime departures. In the case of air and bus travel, the combination of two or more private companies' timetables is implied in the frequency level.

[3] Travel time is one-way. For automobiles, it is assumed that travel takes place at the posted speed limit. Travel time for air, bus and rail is taken from published timetables. All times are based on downtown to downtown travel, with the exception of air, which is airport to airport.

CONCLUSION

As the Boston Region MPO plans for the future transportation needs of the region, the identification of strategies that facilitate travel throughout New England and the Northeast Corridor becomes a primary focus. While the density of population, employment and attractions throughout this part of the country represent one of the region's principal strengths, they also present a significant planning challenge. While other regions have more flexibility and space for roadway and airport expansion, the Boston region faces significant and often insurmountable physical obstacles preventing the expansion of infrastructure. And all regions must deal with significant financial constraints

Over the next twenty years and beyond, the Boston Region MPO must work in concert with Massachusetts state agencies and local representatives, as well as the states of Connecticut, Maine, New Hampshire, Rhode Island and Vermont, to develop transportation strategies that address regional needs despite these constraints. As the demand for air travel continues to grow, the MPO must continue to promote regional solutions. Whether these solutions involve more efficient use of existing facilities at Worcester and Hanscom, or improved partnerships with airports in Rhode Island and New Hampshire, the end result will be Logan Airport's ability to continue as the gateway and transportation hub of the region. By building on the success of Amtrak's Acela service through the promotion of additional high-speed rail corridors to Vermont and Maine, the Boston Region MPO can help to provide the region's travelers with a variety of options for intercity trips. The exploration of commuter rail as a means to solve congestion problems between Boston and cities in southern New Hampshire, southeastern Massachusetts, and T.F. Green Airport will further broaden the spectrum of choices for the region's travelers. Through efficient management of our existing facilities and by targeting new infrastructure to provide more choice the Boston Region MPO can meet regional transportation needs despite the physical and financial challenges it must face.

CHAPTER 9

FREIGHT TRANSPORTATION

A key component of a healthy, vibrant economy for the Boston and New England region is the ability to efficiently move goods and freight within the region. For the most part, the movement of freight is carried out by the private sector using both public and private infrastructure. The main modes of freight movement within the region are truck, rail, water and air.

The efficient movement of freight in the region requires an infrastructure that allows for the smooth transfer of goods to its final destination. Impediments to movement increase the cost of delivery of goods and places a drag on the economy of the region. The two major determinates of how goods are shipped are price of transportation and travel time. The choice of different modes (truck, rail, water or air) best able to deliver goods within a required timeframe for a reasonable price is made by private vendors on a daily basis.

The freight market within Boston and New England is compact in nature. Approximately 95% of all freight shipped through the Port of Boston has a final destination of 75 miles or less. New York City to the south serves as the primary freight distribution center for the Eastern United States. To the north, the deep-water port of Halifax with its excellent rail network provides the Canadian provinces and the United States MidWest with good intermodal freight service. Because of these factors, the truck is the predominant mode of freight movement for the Boston and New England regions.

The rest of this chapter provides a brief overview of each of the modes of travel and discusses the competitive advantages and disadvantages that each faces within the Boston region. There is also a discussion about the major intermodal terminals within the region.

TRUCK

The trucking industry is a privately operated and highly-competitive industry that depends upon the state and local authorities to maintain a safe and efficient highway network. The United States economy depends on the trucking industry for a majority of the shipments of goods to factories, stores and households. This includes both the long-distance movement of goods to and from distribution centers as well as the local deliveries of express packages and household goods.

Conley Terminal

The trucking industry is composed of several major types of operators. These include private fleets owned by businesses or industries to support their own needs, for-hire truckload carriers (TL) that operate over a long distance, and less-than-truckload (LTL) operators who operate regionally and carry smaller loads that TL firms. Each of these types of carriers depends on having a roadway network that meets its needs. Of major concerns are

- having roadways maintained in good condition,
- having intersections that are designed to handle truck turns and movements,
- maintaining bridges that can structurally handle the required weight of a fully-loaded truck, and
- having an interstate and arterial highway network that allows for efficient connectivity to major freight destinations.

Truck freight terminals in the Boston region are concentrated at intersections of major arterial highways. I-95/Route 128 and I-495 have the highest concentration of terminals.

A major problem facing the trucking industry in the Boston region is the lack of a coordinated truck route policy. Because of the nature of how street patterns developed within the Boston region over the past 350 years, it is often common to have truck routes along heavily-populated residential corridors. This causes a conflict between resident's desire for a quiet and safe streetscape and the trucking industries desire for a reasonably direct route between origin and destination. Under Massachusetts law, a community must gain permission from the MassHighway before restricting truck traffic along streets within the community.

The Boston Region MPO conducted a study of truck routes in Cambridge, Boston, Somerville, Arlington, Watertown and Belmont. The truck study was completed in September 2001 and findings and recommendations from that study were considered in the update of the Transportation Plan.

RAIL

The railroad industry in North America has been undergoing a major consolidation of rail companies over the past three years. In the East, Conrail was purchased by the two other Class 1 railroads serving the Eastern United States, CSX and Norfolk Southern. As of June 1999, all of the freight rail lines and associated intermodal facilities previously owned by Conrail in Massachusetts became the property of CSX.

The major products shipped by rail within Massachusetts include automobiles, containers (with and without chassis), bulk products and chemi-

cals. Freight can either be delivered directly to a customer by railside-access, as is the case for industrial users, or delivered to an intermodal freight yard. At this point the truck is the main form of intermodal exchange. Because the Port of Boston has no direct rail access, any containers destined for the port by rail have to be transported from a rail intermodal terminal by truck.

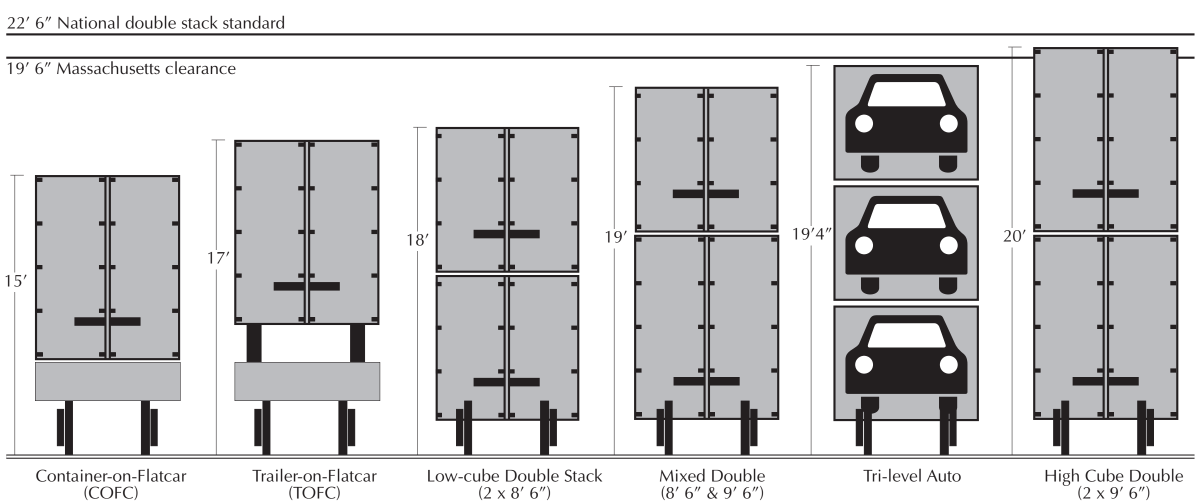
Beacon Yards

Over the past two decades, a major change in the use of rail occurred with the institution of transporting a truck-container car on rail flatbeds, either with or without a chassis. The movement of containers by rail is usually only efficient over long distances. Over short distances, the most efficient movement of containers is over the road. The trend of larger over-the-road shipments to rail has resulted in a closer linking between the rail and truck industry. A more recent improvement is the institution of double-stack rail carriers. This train configuration allows for two container cars to be stacked on one specially designed flatcar. Double-stack shipments by railroads has increased the competitive advantage for rail shipments. But double-stack rail requires a higher bridge clearance. Even one bridge obstacle between the origin and destination will prevent double-stack rail delivery.

The main problem facing railroads in Eastern Massachusetts is the lack of highway bridge clearance heights along existing freight railroad right-of-ways. The preferred national standard for double-stack clearance is 22'6" and at a minimum, 20' 8". This would allow for two 9' 6" containers stacked on top of each other. Presently, double-stack rail service is not possible east of Framingham along the CSX mainline corridor or southeast of Ayer on the Guilford line.

This lack of clearance places CSX's Beacon Yards and the Port of Boston at a competitive disadvantage relative to other freight rail yards or East Coast ports. This increases the cost of shipping goods within the Boston region and reduces

FIGURE 9-1
Rail Car Clearances



the ability of these intermodal centers to compete on the basis of price.

The State of Rhode Island is working on upgrading the P&W rail line from the Port of Quonset to Worcester to allow for double stack rail. This integration into the CSX national system would put Beacon Yards at a disadvantage.

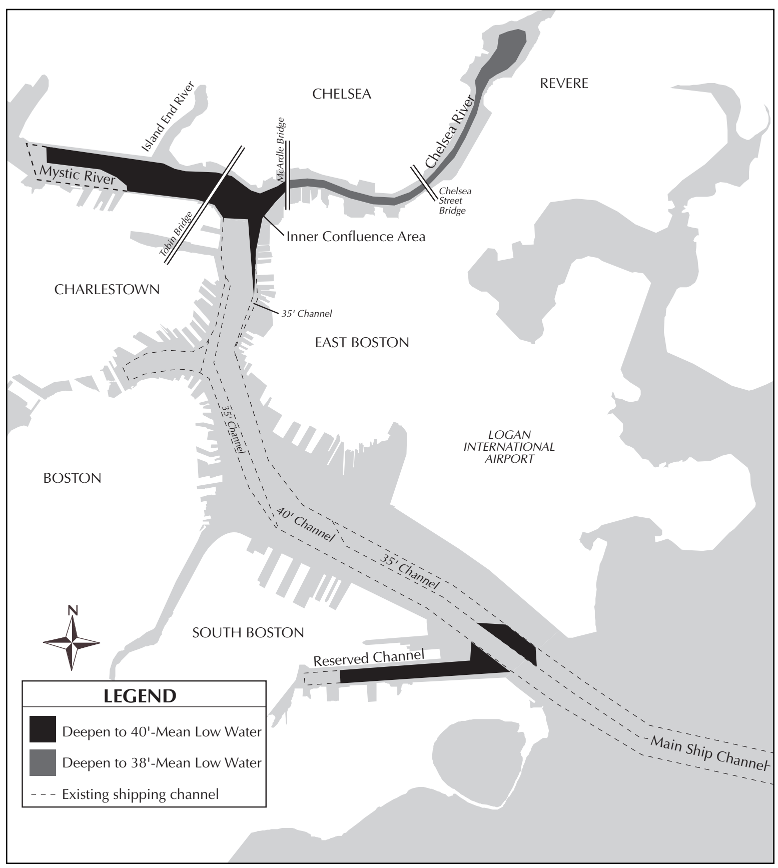
Providing double stack rail capability to the Port of Boston faces two main hurdles. The first is the cost associated with redesigning and building the low-height bridges along the CSX mainline from Worcester to the Boston waterfront. In 1996, the state and Conrail proposed a $200 million rehabilitation program to rebuild the bridges to allow for double stack but that program was put on hold during the sale of Conrail to CSX and Norfolk Southern. Bringing double-stack rail to Conley Terminal is problematic because of the the rail clearance heights under the Prudential Center tunnel.

The second hurdle is that direct on-dock rail access does not exist to Conley Terminal in South Boston, it extends to Massport property adjacent to the Reserve Channel. All container traffic must be drayed by truck the five miles to Beacon Yards and then put on trains. This truck to rail segment puts the port at a competitive cost disadvantage.

Beacon Yards, Boston: This intermodal rail terminal is located within one mile of the Allston toll booths of the MassPike and serves as the major freight transfer point between rail and truck for the Boston region. It also serves as a transfer point for containers that are drayed by truck from Conley Terminal in the Port of Boston. In 1996, approximately 100,000 railcar and intermodal shipments to and from Boston were made with intermodal containers accounting for 70% of this volume. CSX operates eight intermodal freight trains and two general merchandise freight trains daily between Beacon Yards and Selkirk, New York.

In 2000, the Massachusetts Turnpike Authority sold a portion of the land adjacent to the Beacon Yards to Harvard University. Over time this land currently used for freight and vehicle storage will probably be converted into academic use further constraining the land available for a true intermodal freight facility within the city of Boston. The more constraints placed on Beacon Yards, the more difficult it is for the Port of Boston to efficiently distribute freight.

Ayer/Devens Tradeport: This intermodal rail terminal is located just outside of the Boston Region MPO border in the town of Ayer. Guilford/Springfield Terminal Railway operates three separate intermodal facilities within the Ayer area. This includes an Ayer Automobile facility, the Devens Tradeport and the Ayer Warehouse facility. Guilford completed work to increase the rail clearance of the Hoosac Tunnel in Western Mass-



Dredge Work Completed in Boston Harbor

achusetts to allow for tri-level auto carriers to its Ayer facility. But this clearance is not enough to allow high-cube double stack containers. Guilford/Springfield Terminal Railway and Norfolk Southern Railroad have an operating agreement which opens up the northern part of Massachusetts to freight rail on the NS national system.

Chelsea Creek

WATER

The major categories of freight moved by water include refined petroleum products, liquid natural gas, dry bulk commodities such as coal, sand or scrap metal, containers and automobiles. Foreign trade is increasing as more countries of the world join the global marketplace. Increasingly, goods are shipped from these countries by water in containers and then off-loaded on rail or truck for delivery to its final destination.

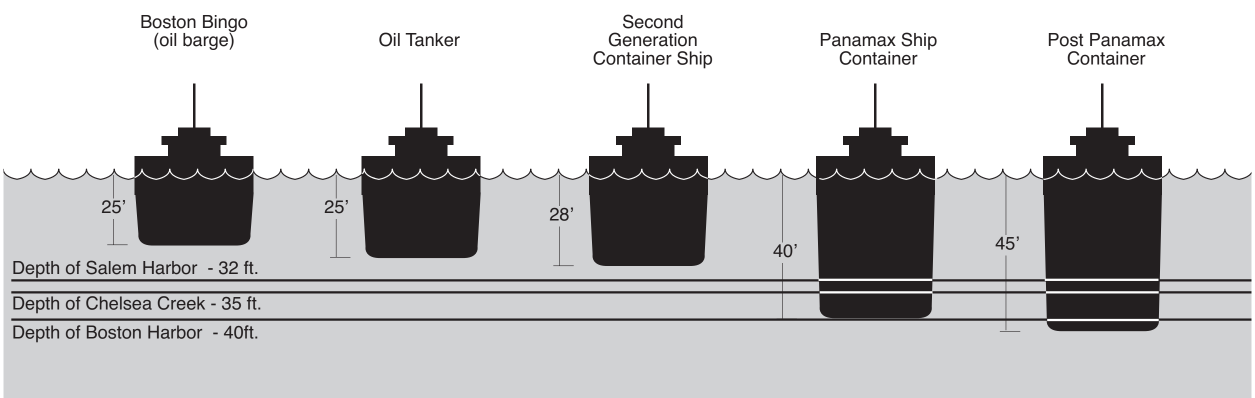
Major trade routes from Boston include barge traffic from the Port of New York/New Jersey and scheduled container ship service from Europe and Asia.

The trend among major container cargo shippers is to use larger and larger container ships. A Post-Panamax ship (one so large it is not capable of navigating the Panama Canal) can carry up to 8,000 Twenty-foot Equivalent Units (TEUs). This trend to larger ships also means that these super carriers will only be calling at a few major ports around the world.

The competition faced by Boston being between New York City and Halifax, Canada is formidable. New York, which also faces problems with the depth of its harbor, is the largest metropolitan area in terms of population in North American and a major transportation hub. Halifax to the north has a natural deep water port with direct dock rail terminals with connections to the Canadian National railroad network. It is also one day closer to the ports of Northern Europe. It is able to handle Post-Panamax ships.

The ports of the Boston region have played a key role in the economic development of New England since the 1600's. The main ports of the Boston region include Gloucester, Salem and Boston.

Port of Boston: Boston is the leading port in New England, serving as the major point of entry for petroleum products such as heating oil and gasoline, containers and bulk products. The port has a natural deep water harbor and anchorage



Port of Boston Cargo Activitiy	1999	1998
Total Port of Boston Cargo Metric Tons	17,065,113	15,986,405
Containerized Cargo		
Import Tons	935,450	890,228
Export Tons	382,502	338,829
Total Tons	1,317,952	1,229,057
Container TEUs	158,051	150,477
Container Vessels	304	305
Bulk Cargo Vessels (in Metric Tons)		
Automobiles	106,506	84,992
Petroleum Products (Estimated)	12,406,296	12,660,404
Salt	535,707	365,840
Liquefied Natural Gas	1,924,972	793,237
Gypsum	186,503	184,695
Cement	249,324	193,104
Other (Fish,Veg,Oil)	98,077	73,033
Total Bulk Imports	15,507,385	14,355,305
Bulk Cargo Exports (in Metric Tons)		
Scrap Metal	238,075	401,329
Other	1701	714
Total Bulk Exports	239,776	402,043
Total Bulk Cargo	15,747,161	14,757,348
Bulk Cargo Vessels/Dock Arrivals	972	1,133
Automobiles (Vehicles)	80,540	64,271
Auto Vessels	84	73

area with direct access to the ocean. The port handles a wide variety of waterborne commerce. Petroleum and petroleum products represent 88% of the volume by weight handled at the port. Massport and the U.S. Army Corps of Engineers recently completed a dredging of the main navigational channel as well as Conley Terminal and the Inner Confluence area. As ships increase in size, the depth of the port and length of time the terminal is from the ocean are becoming increasingly important.

In 2000, Massport and the U.S. Army Corps of Engineers completed a dredging project for Boston Harbor. The main shipping channel was widened and dredged to a consistent 40 foot depth and the Chelsea River and Inner Confluence area were dredged to at least 38 feet. The map on page 9-4 shows the extent of the work completed.

Because the port is facing increasing pressures from other ports along the East Coast, Massport reorganized the water port facilities under its control. Massport's Marine Terminal Optimiza-

tion Plan (MTOP) consolidated all container traffic in the port at Conley Terminal to provide more efficient handling of containers and to reduce the travel time for ships calling on the Port of Boston. The accompanying chart details the port activity for the years 1998 and 1999.

Oil terminals: Oil terminal facilities in Boston Harbor are located in South Boston, Chelsea Creek and Mystic River. A constraint to the efficient delivery of oil is the navigational constraints in the inner confluence area and along the Chelsea Creek. The Chelsea Creek drawbridge spanning Chelsea Creek does not provide a standard amount of width to allow modern tankers to transverse the waterway. Because of this, large oil tankers have to lighten their loads onto smaller barges in the harbor for delivery up the creek. This requires extra time and labor and increases the cost of delivering oil to the Boston area. The Chelsea Creek also has sharp bends and a lack of width for ships to both berth and pass along some portions. These constraints add to the time of delivery and therefore the ultimate cost of transportation.

Conley Terminal is a fully dedicated container terminal located in South Boston. The terminal has 1,950 feet of berthing space with low-profile Post-Panamax container handling cranes. The intermodal terminal has 101 acres of land and serves as the largest container terminal in New England. Before 1998, container traffic was split between Conley Terminal and Moran Terminal. When Moran Terminal was used for container traffic, large container ships had to wait for certain tides to be able to sail under the Tobin Bridge.

Charlestown: Moran Terminal is located in Charlestown. It has a depth of 40 feet with 50 acres of paved open storage space. As part of the MTOP, Moran as well as Mystic Pier 1 have become the Autoport for Boston. Moran handles automobile imports for a variety of automakers including Subaru and Volkswagen. The facility off-loads cars and prepares them for delivery to dealers across New England. The autos are transported from Moran by truck auto-carriers. The lack of clearance for tri-level auto carriers from Ayer to Moran places the Autoport at a competitive disadvantage to the port of Davisville, RI.

Also located in Charlestown is the Massport Mystic Pier Terminal 48, which handles dry bulk cargo (salt). Adjacent is the privately-owned U.S. Gypsum terminal.

Salem Harbor: Salem Harbor is a Designated Port Area (DPA), has a main channel depth of 32 feet. The main commodities handled at the port are coal and fuel oil. The deepwater portion of the harbor serves a power generating plant and as an oil storage facility. Almost 90% of the shipments handled at the harbor are domestic.

Gloucester Harbor: Gloucester is home to a large commercial fishing fleet and serves as a major fish-handling port with the largest cold storage facilities in the United States. It also serves as a port for fuel oil.

Air

Freight moved by air usually contains at least one of the following characteristics- time sensitive, high value-to-weight ratio, and perishable. Air freight cargo is handled either as belly freight in the cargo hold of commercial passenger aircraft or by dedicated freight carriers. Because of the reliance on regularly scheduled commercial passenger service, major air freight carriers are almost always located at large commercial passenger airports.

The only major intermodal movement between air freight and its final destination in the Boston region is by truck. Logan Airport serves as the only air freight terminal in the Boston region. The opening of the Ted Williams Tunnel to commercial traffic in 1996 has improved truck access to the airport from the South Boston and I-93 area.

Logan International Airport serves as the primary air cargo facility for the Boston region. In 1998, it ranked 19th in the US and 36th in the world in terms of cargo handled. Dedicated freight carriers located at Logan Airport include Federal Express, Airborne, DHL and UPS. Cargo volume is split

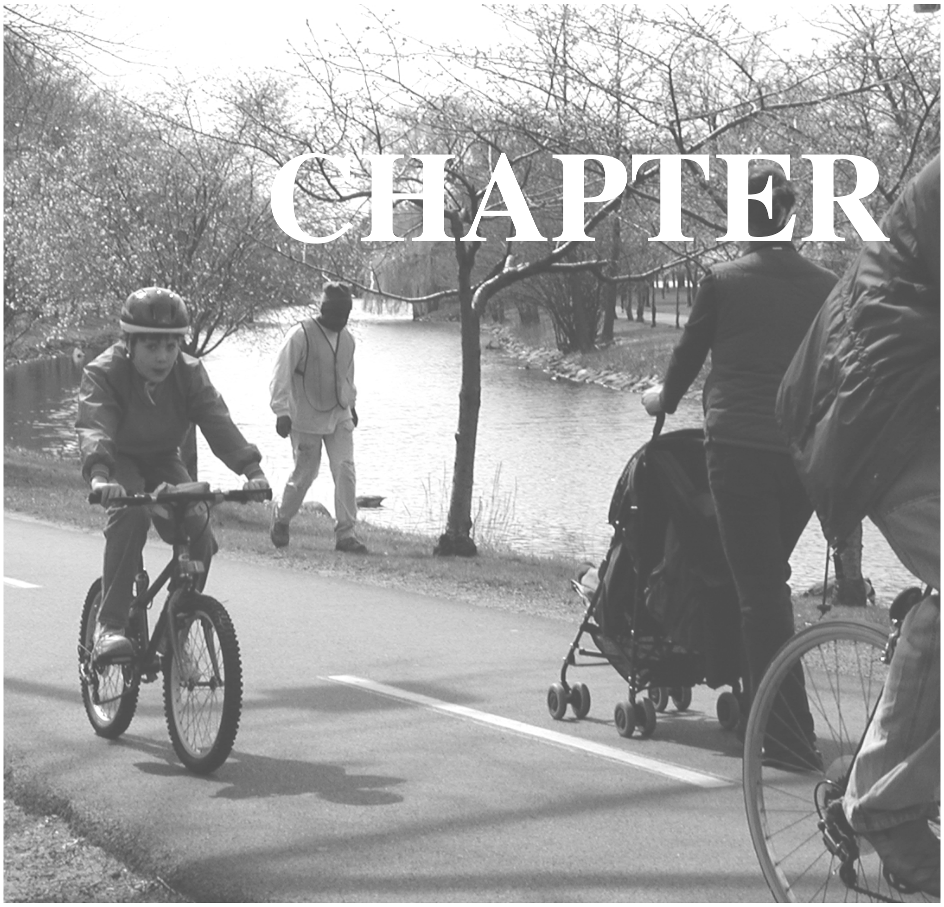
among express/small packages, freight and USPS mail. Table 9-1 shows the freight volumes for the past decade. As can be seen from the chart, the major area of growth is in the express and small packages category. In 1998, there were approximately 11,000 freight-only aircraft operations at Logan, about five percent of total airport flight operations. Most freight-only flights occur outside of the peak congestion periods for Logan Airport, so these freight-only flights do not contribute to the delay problems at Logan. But a majority of these flights occur at night, when noise impacts are more perceptible and disturbing to residents within the flight paths.

TABLE 9-1
Cargo Volumes (in tons) at Logan Airport, 1991–1998

	Express/ Small Packages	Freight	USPS Mail	Total
1991	135,147	189,824	58,321	383,292
1993	167,866	180,978	69,029	417,873
1995	207,733	157,018	70,157	434,907
1997	236,133	171,194	79,757	487,085
1998	236,054	165,867	83,461	485,382

Note: there has been a 27% growth in freight volume from 1991 to 1998

The two main cargo handling facilities at Logan Airport are the North Cargo Area, located along Route 1A-north of the Airport MBTA station, and the Bird Island Flats/South Cargo Area, located south of Terminal B and bordering the Boston Harbor. All freight movement to and from the airport occurs by truck. There is no freight rail access to Logan Airport, and no provisions for future rail access as a rail travel market would be unlikely to develop for air freight commodities. Massport is exploring the concept of building a truck haul road from the North Cargo Area along the abandoned Conrail right-of-way.



CHAPTER 10

RECOMMENDED PLAN

BACKGROUND

The recommended list of projects contained in this chapter represents the Boston Region MPO's priorities for major projects to the year 2025. It builds on the 2000 Plan, which included an extremely constrained list of projects composed of legal commitments and projects that were programmed in the six-year Boston Region MPO Transportation Improvement Program.

Reinvestment in the existing system is the top priority of the Boston Region MPO. In this plan, as in the 2000 Plan, the MPO has allocated 70% of future transit capital funding for system infrastructure maintenance, accessibility improvements and system enhancements. The remaining 30% is allocated to system expansion. Similarly, on the roadway side, this plan allocates 70% of future capital (non-Artery) highway funding to maintaining the existing infrastructure, while the remaining 30% is allocated to roadway expansion.

RECOMMENDED LAND USE SCENARIO

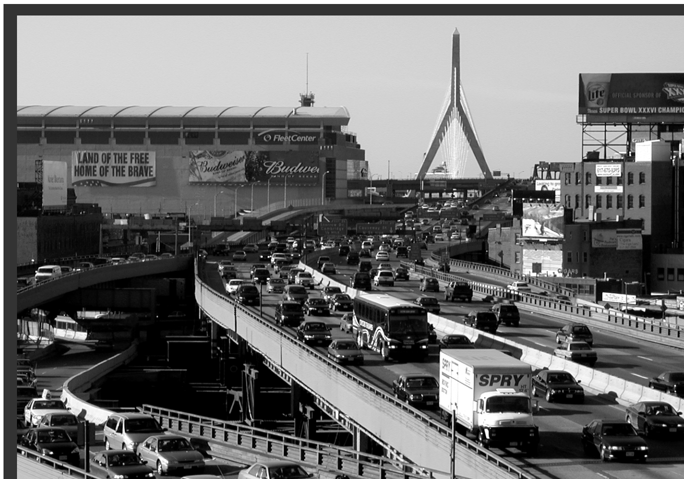
Federal regulations stipulate that the MPO planning process consider the consistency of transportation plans with long-term land use and development plans and projections. During the development of the Plan Update, two different land use scenarios provided by MAPC were used for the purpose of analyzing various sets of transportation projects. Both land use scenarios were input into the regional travel model to test alternative transportation networks.

The MPO selected the Targeted Growth land use scenario for inclusion with the recommended projects for modeling for the conformity determination. This scenario, which is explained in detail in Chapter 2 and Appendix H, is based on current zoning and MetroPlan, the region's adopted land use plan. Development allowed by current zoning is assumed to continue at its 20-year average trend until it reaches buildout or until the forecast demand for water and sewer capacity exceeds a community's ability to pro-

vide it. Additional development demand is then allocated to communities with remaining water and sewer capacity and, generally, with commuter rail and other transit services available. The reallocation pattern is consistent with existing and expected constraints on water and sewer capacity, as well as with MetroPlan's goal of promoting denser development in areas where infrastructure already exists.

Recommended List of Planned Expansion Projects

The 30% capacity program is available to fund the costs of projects currently underway and those that constitute the planned expansion of the transportation system. Due to differences in contracting and accounting regulations and practices, the ongoing (non-Artery) projects for which the MPO has an outstanding obligation are limited to the transit program. The following ongoing regionally significant projects are funded in the transportation plan:



Central Artery Project

- The Central Artery Project – the total budget for this project is approximately $14.5 billion and the costs funded under this transportation plan are $4.5 billion (includes the repayment of $1.5 billion in Grant Anticipation Notes). This project has differing opening dates for its various segments, including many that are already in service. The final completion of the project is scheduled for December 31, 2004.
- The Silver Line, Phase 1 (Washington Street) – the total budget for the project is approximately $78 million and the total amount is funded under this transportation plan. The projected start of service is Spring 2002.
- The Silver Line, Phase 2 (South Boston Piers Transitway) – the total budget for the project is approximately $601 million and the remaining costs funded under this transportation plan are $321 million. The projected start of service is Winter 2003/2004.
- Worcester Commuter Rail – the total budget for the project is approximately $97.2 million and the remaining costs funded under this transportation plan are $26 million. The final three stations are projected to open to service in 2002, as follows: Westborough on June 3rd, Southborough on June 17th and Ashland on August 19th.

After accounting for the costs of these ongoing projects, the remaining funds available in the 30% capacity program are dedicated to planned expansion projects. An expansion project is any project that adds capacity to the existing system through the addition of a travel lane, the construction of an interchange, the construction of a commuter rail extension or transit line, or the procurement of additional (not replacement) public transportation vehicles. Table 10-1 lists the projects funded under the 30% capacity program.

During the development of this Transportation Plan Update, the MPO determined that there would be no "flexing" of funds from one mode to another and that funding would be segregated by use. Thus, in this plan highway funds are used to fund highway projects and public transportation funds are used to fund improvements to the regional public transportation system. Based upon this distinction, the 30% capacity program yields approximately $1.5 billion for non-Artery highway projects and $2.3 billion for transit projects,

TABLE 10-1
Regionally Significant Projects in the Recommended Plan

Total Capital Funds Programmed in the Plan Update:	$18,198,000,000	
less Funding Dedicated to the Central Artery:	$4,488,000,000	
less Assumed Discretionary Federal Transit Funds (see, Notes 2 & 4):	$875,000,000	
yields Funding Available for the Regional Transportation System:	$12,835,000,000	
less Funding Dedicated to Maintenance and Improvement (70%):	$8,984,500,000	
yields Funding Available for Capacity Improvements (30%):	$3,850,500,000	

	Estimated Cost	Included in Model for Air Quality
All Capacity Improvemeent Projects		
Crosby Dr. (Bedford)	$3,500,000	Y
Middlesex Turnpike (Bedford & Burlington)	$9,000,000	Y
Rte. 128 Capacity Improvements (Beverly to Peabody)	$60,000,000	Y
Arborway Restoration (Boston)	$85,000,000	Y
100 Additional Buses to Improve Service on Existing Routes	$38,700,000	Y
East Boston Haul Rd./Chelsea Truck Route (Boston)	$12,000,000	Y
Fairmount Branch Improvements (Boston)	$29,600,000	Y
Red Line/Blue Line Connector (Boston) [Note 1]	$193,000,000	Y
Rte. 1A/Boardman St. Grade Separation (Boston)	$8,500,000	Y
Russia Wharf Ferry Terminal (Boston)	$5,000,000	N
Rutherford Avenue (Boston)	$50,000,000	Y
Silver Line, Phase 3 (60/40)(Boston) [Note 2]	$950,000,000	Y
New Bedford/Fall River Commuter Rail (Boston to New Bedford)	$610,000,000	Y
Double Stack Initiative (Boston to Newton) [Note 3]	$20,000,000	N
Old Colony/Greenbush Commuter Rail (Boston to Scituate)	$419,000,000	Y
Medford Hillside Green Line (60/40) (Boston, Medford, & Somerville)[Note 2]	$375,000,000	Y
Urban Ring, Phase 1 (80/20) (Compact Communities*) [Note 4]	$100,000,000	Y
Mass. Ave./Lafayette Square (Cambridge)	$3,415,000	Y
Cambridgeport Roadways (Cambridge)	$4,000,000	Y
I-93/I-95 Interchange (Canton)	$27,500,000	Y
I-95 (NB)/Dedham St. Ramp (Canton)	$3,000,000	Y
I-95 (SB)/Dedham St. Onramp (Canton)	$1,200,000	Y
Concord Rotary (Concord)	$35,000,000	Y
Rte. 2/Crosby's Corner (Concord)	$10,500,000	Y
Rte. 1/114 Corridor Improvements (Danvers & Peabody)	$40,000,000	Y
Telecom City Roadways (Everett, Malden, & Medford)	$18,000,000	Y
Revere Beach Parkway (Everett, Medford, & Revere)	$54,000,000	Y
Rte. 126/Rte. 135 Grade Separation (Framingham)	$50,000,000	Y
Rte. 9/Rte. 126 Interchange (Framingham)	$15,000,000	Y
Double Stack Initiative (Framingham to Worcester) [Note 3]	$8,000,000	N
Rte. 140 (Franklin)	$18,000,000	Y
Rte. 53 (Hanover)	$4,000,000	Y
Rte. 53/Rte. 228 (Hingham & Norwell)	$2,500,000	Y
Naval Air Station Access Improvements	$87,500,000	Y
I-495/I-290/Rte. 85 Interchange (Hudson & Marlborough)	$25,000,000	Y
Rte. 128 Capacity Improvements (Lynnfield to Reading)	$50,000,000	Y
Rte. 1 Improvements (Malden & Revere)	$33,600,000	Y

TABLE 10-1(CONT.)
Regionally Significant Projects in the Recommended Plan

Rte. 20, Segments 2 & 3 (Marlborough)	$7,200,000	Y
Double Stack Initiative (Natick & Wellesley) [Note 3]	$20,000,000	N
Needham St./Highland Ave. (Needham & Newton)	$6,600,000	Y
Burgin Parkway (Quincy)	$18,000,000	Y
Quincy Center Concourse, Phase 2 (Quincy)	$6,000,000	Y
Rte. 128 Additional Lanes (Randolph to Wellesley)	$97,000,000	Y
I-93/Rte. 129 Interchange (Reading & Wilmington)	$15,000,000	Y
I-93/I-95 Interchange (Reading & Woburn)	$75,000,000	Y
Mahoney Circle Grade Separation (Revere)	$25,000,000	Y
Rte. 1/Rte. 16 Interchange (Revere)	$3,900,000	Y
Rte. 1A/Rte. 16 Connection (Revere)	$39,600,000	Y
Boston St. (Salem)	$2,000,000	Y
Bridge St. (Salem)	$3,000,000	Y
Bridge St. Bypass (Salem)	$12,300,000	Y
Assembly Square Orange Line Station (Somerville) [Note 5]	$20,000,000	Y
I-93/Mystic Ave. Interchange (Somerville)	$50,000,000	Y
Rte. 18 (Weymouth)	$15,000,000	Y
Rte. 3 South Additional Lanes (Weymouth to Duxbury)	$180,000,000	Y
I-93/Ballardvale St. Interchange (Wilmington)	$15,000,000	Y
New Boston Street Bridge (Woburn)	$2,000,000	Y
Subtotal Planned Capacity Improvement Costs:	$4,051,115,000	
plus Costs of Ongoing (No-Build) Projects:	$425,000,000	
plus Regionwide Associated Costs for Roadway Projects (Engineering, ROW, etc.)	$245,663,000	
plus Funding Dedicated to the Central Artery:	$4,488,000,000	
yields Total Capacity Improvement Costs:	$9,209,778,000	
less Assumed Discretionary Federal Funds (see, Notes 2 & 3):	$875,000,000	
less Funding Dedicated to the Central Artery:	$4,488,000,000	
yields Total Funding Currently Available Under the 30% Capacity Program:	$3,846,778,000	

Note 1: This project is currently a legal commitment under the State Implementation Plan (SIP). The MPO has serious doubts about the advisability of funding this project, given the construction of the Silver Line and the Airport Intermodal Connection. The MBTA is undertaking a study of the comparative benefits of these projects and may ultimately pursue a substitution under the SIP. If the substitution is permitted, the MPO will consider amending the Regional Transportation Plan (RTP) to allocate these project funds to other uses, possibly possibly including parking expansion, frequency improvements, phase 2 of the Urban Ring, or Washington Street light rail service.

Note 2: The MBTA will be seeking federal New Start funding for these projects. The MPO financial plan assumes that 60% of the total project costs will be funded with federal revenues.

Note 3: The funding for the double stack initiative is equal to half the estimated total cost; the remaining cost will be funded under the 70% of funds reserved for maintenance and improvements.

Note 4: The MBTA will be seeking federal § 5309 Bus funding for this project. The MPO financial plan assumes that 80% of the total project costs will be funded with federal revenues.

Note 5: The MBTA and the City of Somerville are pursuing private funding for this facility, including the possible use of Transportation Infrastructure Finance and Innovation Act (TIFIA) funds. The use of TIFIA funding for this project would probably necessitate the development of the Assembly Square area as a large, unified project with the new transit station as an integral, non-divisible component. These funds are not included in the Table's subtotal and totals.

*Compact Communities include Boston, Brookline, Cambridge, Somerville, Medford, Everett and Chelsea.

including $425 million in funds allocated to the ongoing transit projects referenced above. The MPO has decided to use some of these transit funds to attempt to leverage an additional $875 million in federal funds beyond those currently assumed in the 30% capital program. Table 10-2, shows the total amount of funding dedicated to expansion projects in the Plan Update.

TABLE 10-2
Funding Dedicated to Expansion Projects

The Central Artery Project	**$4,448,000,000**
Non-Artery Highway Projects (30% Capacity Program)	**$1,495,355,000**
Highway Subtotal	**$5,943,355,000**
Transit Projects (30 % Capacity Program)	**$2,343,000,000**
Additional Federal Funds Assumed in the 30% Capacity Program	**$876,200,000**
Transit Subtotal	**$3,219,200,000**
Expansion Project Total	**$9,162,555,000**

The highway and transit projects funded under the 30% capacity program were selected for inclusion in the Plan Update based upon the professional judgment of the various MPO members after reviewing myriad sources of information, including:

- results from the regional travel demand model;
- information produced on projects through feasibility studies, project-specific modeling work, and environmental impact reports;
- a matrix examining each individual project for conformity with the MPO's transportation policies;
- recommendations from the MPO's citizen advisory council and environmental justice committee;
- MPO member's personal knowledge of proposed projects; and
- feedback from the public outreach process.

Map 10-1 is shows the location of the planned expansion projects included in the 30% capacity program and Table 10-3 reflects the highway projects that are funded under the 30% capacity program, as explained below.

Highway Projects in the Recommended Plan

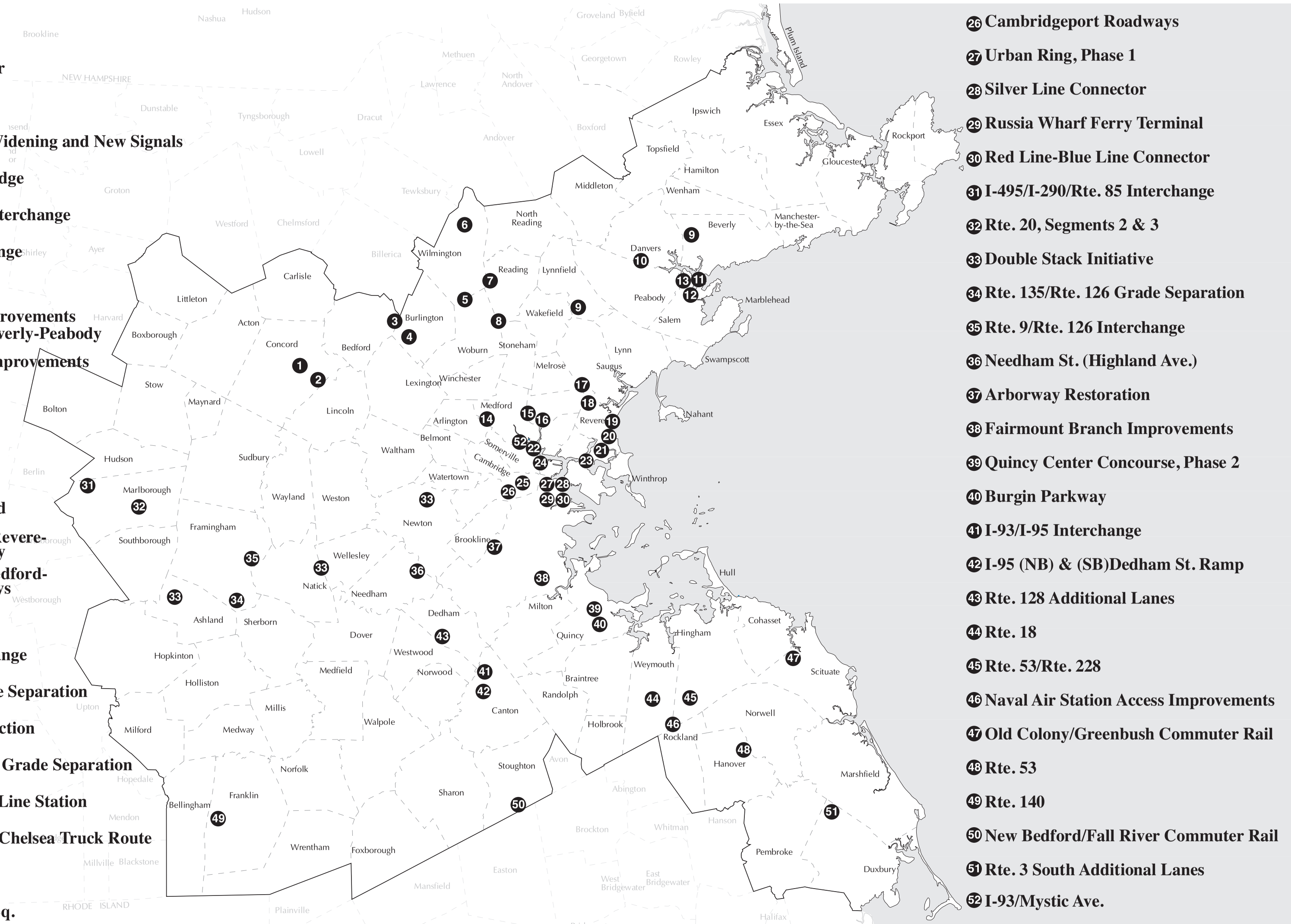
Crosby Drive (Bedford): Crosby Drive in Bedford will have a five-lane cross section with two travel lanes in each direction with a center turn lane for its entire length. The project also includes a slip ramp to Route 3 Northbound. This project will address congestion and traffic flow problems related to recent and continuing development in the area and will facilitate future growth in the nearby industrial park. The benefits of the project include operational improvements at affected intersections, associated travel time savings, and economic development opportunities.

Middlesex Turnpike (Bedford and Burlington): Middlesex Turnpike will be widened by one travel lane in each direction with a sixteen foot raised median from Route 62 in Bedford to Manning Road in Billerica. This project will address congestion and traffic flow problems related to recent and continuing development in the area and will facilitate future growth in the nearby industrial park. The benefits of the project include a lessening of traffic congestion, operational improvements at affected intersections, associated travel time savings, and economic development opportunities.

Route 128 Capacity Improvements (Beverly to Peabody): This project will address safety problems, congestion, and traffic flow in the corridor. The need to provide for additional trips has been identified for the area centered along Route 128 from approximately I-95 in Peabody to Brimbal

Map 10-1
Expansion Projects in the Recommended Plan

1 Concord Rotary
2 Rte. 2/Crosby's Corner
3 Crosby Dr.
4 Middlesex Turnpike Widening and New Signals
5 New Boston Street Bridge
6 I-93/Ballardvale St. Interchange
7 I-93/Rte. 129 Interchange
8 I-93/I-95 Interchange
9 Rte. 128 Capacity Improvements Lynnfield-Reading/Beverly-Peabody
10 Rte. 1/114 Corridor Improvements
11 Bridge St.
12 Bridge St. Bypass
13 Boston St.
14 Green Line to Medford
15 Everett, Medford & Revere-Revere Beach Parkway
16 Everett, Malden & Medford-Telecom City Roadways
17 Rte. 1 Improvements
18 Rte. 1/Rte. 16 Interchange
19 Mahoney Circle Grade Separation
20 Rte. 1A/Rte. 16 Connection
21 Rte. 1A/Boardman St. Grade Separation
22 Assembly Sq. Orange Line Station
23 East Boston Haul Rd./Chelsea Truck Route
24 Rutherford Avenue
25 Mass. Ave./Lafayette Sq.



26 Cambridgeport Roadways
27 Urban Ring, Phase 1
28 Silver Line Connector
29 Russia Wharf Ferry Terminal
30 Red Line-Blue Line Connector
31 I-495/I-290/Rte. 85 Interchange
32 Rte. 20, Segments 2 & 3
33 Double Stack Initiative
34 Rte. 135/Rte. 126 Grade Separation
35 Rte. 9/Rte. 126 Interchange
36 Needham St. (Highland Ave.)
37 Arborway Restoration
38 Fairmount Branch Improvements
39 Quincy Center Concourse, Phase 2
40 Burgin Parkway
41 I-93/I-95 Interchange
42 I-95 (NB) & (SB)Dedham St. Ramp
43 Rte. 128 Additional Lanes
44 Rte. 18
45 Rte. 53/Rte. 228
46 Naval Air Station Access Improvements
47 Old Colony/Greenbush Commuter Rail
48 Rte. 53
49 Rte. 140
50 New Bedford/Fall River Commuter Rail
51 Rte. 3 South Additional Lanes
52 I-93/Mystic Ave.

TABLE 10-3
Regionally Significant Highway Projects in the Recommended Plan

Total Capital Highway Funds Programmed in the Plan Update:	$9,464,000,000
less Funding Dedicated to the Central Artery:	$4,488,000,000
yields Funding Available for the Regional Highway System:	$4,976,000,000
less Funding Dedicated to Maintenance and Improvement (70%):	$3,483,200,000
yields Funding Available for Capacity Improvements (30%):	$1,492,800,000

	Estimated Cost	Included in Model for Air Quality
Highway Projects		
Crosby Dr. (Bedford)	$3,500,000	Y
Middlesex Turnpike (Bedford & Burlington)	$9,000,000	Y
Rte. 128 Capacity Improvements (Beverly to Peabody)	$60,000,000	Y
East Boston Haul Rd./Chelsea Truck Route (Boston)	$12,000,000	Y
Rte. 1A/Boardman St. Grade Separation (Boston)	$8,500,000	Y
Rutherford Avenue (Boston)	$50,000,000	Y
Double Stack Initiative (Boston to Newton) [Note]	$20,000,000	N
Mass. Ave./Lafayette Square (Cambridge)	$3,415,000	Y
Cambridgeport Roadways (Cambridge)	$4,000,000	Y
I-93/I-95 Interchange (Canton)	$27,500,000	Y
I-95 (NB)/Dedham St. Ramp (Canton)	$3,000,000	Y
I-95 (SB)/Dedham St. Onramp (Canton)	$1,200,000	Y
Concord Rotary (Concord)	$35,000,000	Y
Rte. 2/Crosby's Corner (Concord)	$10,500,000	Y
Rte. 1/114 Corridor Improvements (Danvers & Peabody)	$40,000,000	Y
Telecom City Roadways (Everett, Malden, & Medford)	$18,000,000	Y
Revere Beach Parkway (Everett, Medford, & Revere)	$54,000,000	Y
Rte. 126/Rte. 135 Grade Separation (Framingham)	$50,000,000	Y
Rte. 9/Rte. 126 Interchange (Framingham)	$15,000,000	Y
Double Stack Initiative (Framingham to Worcester) [Note]	$8,000,000	N
Rte. 140 (Franklin)	$18,000,000	Y
Rte. 53 (Hanover)	$4,000,000	Y
Rte. 53/Rte. 228 (Hingham & Norwell)	$2,500,000	Y
Naval Air Station Access Improvements	$87,500,000	Y
I-495/I-290/Rte. 85 Interchange (Hudson & Marlborough)	$25,000,000	Y
Rte. 128 Capacity Improvements (Lynnfield to Reading)	$50,000,000	Y
Rte. 1 Improvements (Malden & Revere)	$33,600,000	Y
Rte. 20, Segments 2 & 3 (Marlborough)	$7,200,000	Y
Double Stack Initiative (Natick & Wellesley) [Note]	$20,000,000	N
Needham St./Highland Ave. (Needham & Newton)	$6,600,000	Y
Burgin Parkway (Quincy)	$18,000,000	Y
Quincy Center Concourse, Phase 2 (Quincy)	$6,000,000	Y
Rte. 128 Additional Lanes (Randolph to Wellesley)	$97,000,000	Y
I-93/Rte. 129 Interchange (Reading & Wilmington)	$15,000,000	Y
I-93/I-95 Interchange (Reading & Woburn)	$75,000,000	Y
Mahoney Circle Grade Separation (Revere)	$25,000,000	Y
Rte. 1/Rte. 16 Interchange (Revere)	$3,900,000	Y
Rte. 1A/Rte. 16 Connection (Revere)	$39,600,000	Y

Table 10-3 (cont.)
Regionally Significant Highway Projects in the Recommended Plan

Boston St. (Salem)	**$2,000,000**	**Y**
Bridge St. (Salem)	**$3,000,000**	**Y**
Bridge St. Bypass (Salem)	**$12,300,000**	**Y**
I-93/Mystic Ave. Interchange (Somerville)	**$50,000,000**	**Y**
Rte. 18 (Weymouth)	**$15,000,000**	**Y**
Rte. 3 South Additional Lanes (Weymouth to Duxbury)	**$180,000,000**	**Y**
I-93/Ballardvale St. Interchange (Wilmington)	**$15,000,000**	**Y**
New Boston Street Bridge (Woburn)	**$2,000,000**	**Y**
Subtotal Non-Artery Highway Capacity Improvement Costs:	**$1,245,815,000**	
plus **Regionwide Associated Costs (Engineering, ROW, etc.):**	**$245,663,000**	
yields **Total Planned Non-Artery Highway Capacity Improvement Costs:**	**$1,491,478,000**	

Note: The funding for the double stack initiative is equal to half the estimated total cost; the remaining cost will be funded under the 70% of funds reserved for maintenance and improvements.

Avenue in Beverly. The initial stage in this process will be a detailed evaluation of all alternatives for moving additional persons in this corridor. Because of existing safety problems, implementation of improvements may be phased to address more immediate concerns first. The project area constitutes the oldest remaining original construction on Route 128 and was built to 1950's design standards. The lane volumes for the southern end of the corridor in Peabody are the second highest on any portion of Route 128, trailing only the segment from Randolph to Needham.

East Boston Haul Road (Chelsea Truck Route): Existing rail right-of-way from Logan Airport to Chelsea will be converted into an exclusive truck route. The route will be grade separated running beneath Day square. This project will reduce truck traffic in East Boston by providing a direct grade-separated connection between the Chelsea Street Bridge and Logan Airport. In addition, the MBTA envisions sharing the route as part of Phase 2 of the Urban Ring (currently an illustrative project in the plan).

Route 1A/Boardman Street Grade Separation (Boston): Construction of an overpass with ramps to replace the existing intersection of Route 1A and Boardman Street. Boardman Street would be relocated approximately 400 feet south of its current location. This project will improve the flow of traffic on Route 1A between Logan Airport and Bell Circle in Revere by eliminating an at-grade, signalized intersection. It will also provide safety benefits at the intersection location.

Rutherford Avenue (Boston): From City Square to the Tobin Bridge ramps, Rutherford Avenue is reduced from 10 lanes to 5 (3 southbound and 2 northbound). From the Tobin Bridge ramps to Bunker Hill Community College, southbound traffic is on the surface with an intersection at the Gilmore Bridge. Northbound traffic is in a one-way neighborhood street separated from the southbound lanes by a landscape buffer. Route 99 underpass remains. Surface intersections in Sullivan Square would replace the existing rotary. One lane of Rutherford Ave. is eliminated in each direction at Sullivan Square. Taking advantage of the construction of the Central Artery Project, this project will more appropriately balance the functionality of Rutherford Avenue with the function and character of the surrounding land uses.

Double Stack Initiative (Boston to Newton): All bridges crossing over the CSX rail line from Beacon Yards to Route 128 would be raised to accommodate double stack freight trains. One-half of the cost of this initiative will be funded under the 70% maintenance and improvement program. This project will improve rail access to the Port of Boston and will make the port more

attractive in the highly competitive sea freight market. Its benefits include a probable increase in freight business for the port, as well as the possible reduction of truck traffic related to the movement of goods from the port.

Massachusetts Avenue/Lafayette Square (Cambridge): This project realigns the intersection of Massachusetts Avenue, Main Street and Columbia Street. The signalized intersection would be moved to a realigned 4-way intersection opposite Sidney Street on the south. The benefits of this project include better signal coordination on Massachusetts Avenue and improved pedestrian and bicycle safety.

Cambridgeport Roadways: Street patterns in Cambridgeport from Massachusetts Avenue to Memorial Drive will be realigned including Sidney Street, Waverly Street, Albany Street and Brookline Street. The benefits of the project include the diversion of traffic away from neighborhood streets, traffic flow improvements, and economic development opportunities.

I-93/I-95 Interchange (Canton): Improvements to all connections between I-93 and I-95. Ramps from Route 128 southbound to I-95 southbound and from I-95 northbound to I-93 northbound would be widened from one lane to two lanes. The connection between I-93 southbound and I-95 southbound would be realigned and improved. The inner loop ramp from I-95 northbound to Route 128 northbound would be removed and replaced by a high-speed connection. Finally, a new ramp from University Avenue to Interstate 93 northbound via a new Greenlodge Street bridge would be constructed. The benefits of the project include managing traffic congestion, operational improvements at affected intersections, associated travel time savings, and significant improvements in safety including a projected reduction in truck rollovers.

I-95 (NB)/Dedham Street Ramp (Canton): New northbound off ramp to Dedham Street, including the installation of a signal. This project will provide direct access to the Town of Canton and the Town of Westwood's University Avenue industrial area from Interstate 95 northbound. The benefits of the project include the elimination of the need for a circuitous route through Canton and increased economic development possibilities in Westwood.

I-95 (SB)/Dedham Street Onramp (Canton): Construction of a new southbound ramp to I-95 from Dedham Street. There is no signal at the onramp. This project will provide direct access to Interstate 95 (South) from Westwood's University Avenue industrial area. The benefits of the project include management of congestion and delays at the current access point (Blue Hill Drive) and improved access for commuters wishing to use the Route128 commuter rail station.

Concord Rotary: An interchange between Route 2 and Route 2A will be constructed at the site of the Concord Rotary. Route 2 traffic will pass under a new ramp that connects Route 2A east traffic to Route 2 east. Surface ramps will link Route 2 west with Route 2A west and Route 2A east with Route 2 west. The benefits of the project include a lessening of traffic congestion, operational improvements at affected intersections, associated travel time savings, and significant improvements in safety.

Route 2/Crosby's Corner (Concord and Lincoln): Grade separation of intersection of Route 2 and Route 2A in Concord. No added travel lanes. Safety improvements are included along 2-mile stretch of Route 2 from Bedford Road in Lincoln to Route 126 in Concord. This project is primarily aimed at improving safety at this dangerous intersection, but will also improve congestion.

Route 1/114 Corridor Improvements (Danvers and Peabody): Elimination of center turn lane and widening of Route 114 from 2 to 3 lanes in each direction from Watson Parkway to just east of railroad bridge (1.1 miles). Construction of a diamond interchange at Route 114 and Route 1. The benefits of this project include improved traffic flow in the corridor, a reduction in congestion, and improved safety.

Telecom City Roadways (Everett, Malden, and Medford): Reconstruction of Commercial Street

at Medford Street in Malden to include new traffic signal equipment serving four 11-foot lanes plus 4-foot outside shoulders. In the southbound direction, the alignment of the existing reverse s-curve will be flattened. Commercial Street will include a northbound and a southbound lane separated by a median, which will be narrowed at several locations to accommodate a protected southbound left turn lane. A new road connects Corporation Way with Santilli Highway. The primary benefit of this project is the facilitation of a significant economic development opportunity related to a large brownfield.

Revere Beach Parkway (Everett and Medford): Includes grade separation of Wellington Circle. Except for a four-lane segment under Wellington Circle, the project will provide a continuous 6-lane mainline parkway cross-section between Route 38 in Medford and Sweetser Circle in Everett. This can be achieved by creating a 'traffic management lane' on the south side of the Parkway between Locust Street and the Wellington Circle off-ramp access point. Within the parkway study area, all signals between Route 38 and Santilli Circle should be coordinated for a 30 miles per hour speed typical for urban centers. Its benefits include managing of traffic congestion, operational improvements at affected intersections, and associated travel time savings.

Route 126/135 Grade Separation (Framingham): Construction of a below-grade underpass (one lane in each direction) on Route 126 beginning on the north at Park Street and on the south near Irving Street. It will pass beneath the rail crossing and Route 135. Travel lanes will also be maintained at grade at the Route 126/135 intersection with an upgraded signal. The benefits of this project include a lessening of traffic congestion, operational improvements at the affected intersection, associated travel time savings, and associated reductions in air pollution.

Route 9/Route 126 Interchange (Framingham): Improve the existing interchange at Route 9 (Worcester Road) and Route126 (Concord Street). The Route 126 bridge is listed in the Statewide Road and Bridge list and its reconstruction would be a major element of this project. The benefits of this project include operational improvements at the affected intersection, associated travel time savings, and improved safety.

Double Stack Initiative (Framingham to Worcester): All bridges crossing over the CSX rail line from Framingham to Worcester would be raised to accommodate double stack freight trains. One-half of the cost of this initiative will be funded under the 70% maintenance and improvement program. This project will improve rail access to the Port of Boston and will make the port more attractive in the highly competitive sea freight market. Its benefits include a probable increase in freight business for the port, as well as the possible reduction of truck traffic related to the movement of goods from the port.

Route 140 (Franklin): Route 140 is to be widened from one lane in each direction to two lanes in each direction from I-495 to Garelick Farms. The alignment of Route140 will also be altered to accommodate an improved diamond interchange. The length of Route 140 affected is 1.2 miles. The benefits of the project include a lessening of traffic congestion, operational improvements at the affected interchange, associated travel time savings, and economic development opportunities.

Route 53 (Hanover): Route 53 is widened from Mill Street to Pond Street from the existing 32-foot cross section to a 66-foot cross section with two lanes in each direction and a center turn lane. A 4-way intersection will be realigned to include Pond Street, Route 53 and Washington Street. The benefits of the project include a lessening of traffic congestion, operational improvements at affected intersections, associated travel time savings, and improved safety.

Route 53/228 (Hingham and Norwell): Widen Route 53 in Hingham to a three-lane cross section, to include a center turning lane. Also, widen the approaches at the Route 228 intersection and the High Street/Grove street intersection. The benefits of the project include a lessening of traffic congestion, operational improvements at

affected intersections, associated travel time savings, and improved safety.

South Weymouth Naval Air Station Access Improvements (Hingham, Rockland, and Weymouth): The primary benefit of this project is the facilitation of a significant economic development opportunity related to reuse of the Naval Air Station. To support this reuse, as the final plan evolves, transportation improvements will be coordinated and alternatives will be evaluated as part of the ongoing Environmental Impact Review. The EIR will include alternatives such as new roadway connections between the air station, Route 18, and Route 3, the construction of a regional intermodal facility, and improved bicycle and pedestrian connections. The project(s) identified in the final EIR will be considered for funding as part of the Regional Transportation Plan.

I-495/I-290/Route 85 Interchange (Hudson and Marlborough): Interchange improvements at the junction of I-495 and I-290 include the construction of a flyover ramp from I-495 northbound to I-290 westbound and a flyover ramp from I-290 eastbound to I-495 northbound. The benefits of the project include operational improvements at the affected interchange, associated travel time savings, and improved safety.

Route 128 Capacity Improvements (Lynnfield to Reading): This project will address safety problems, congestion, and traffic flow in the corridor. The need to provide for additional trips has been identified for the area centered along Route 128 from approximately Route 1 in Lynnfield and Route 28 in Reading. The initial stage in this process will be a detailed evaluation of all alternatives for moving additional persons in this corridor. If existing safety problems are reported, implementation of improvements may be phased to address more immediate concerns first.

Route 1 Improvements (Malden and Revere): Reconstruct Route 1 as a six-lane highway between Copeland Circle and Route 99. Within this section of roadway, reconstruct the railroad bridge and the Lynn Street interchange to address existing safety problems, and the Route 1/Route 99 Interchange. Since safety problems resulting from obsolete ramp designs have been identified, this study could be divided into two projects, with safety improvements pursued before final capacity enhancements are constructed. A solution to safety and congestion problems along Route 1 in Saugus north of this area may also be necessary before the widening of Route 1 in Malden and Revere can proceed. The benefits of the project include managing traffic congestion, associated travel time savings, and improved safety.

Route 20, Segments 2 & 3 (Marlborough): From Farm Road to the Sudbury line, Route 20 will be widened from one to two lanes in each direction. The 0.9-mile portion of Route 20 from Felton Street to Ames Street will also be widened from one to two lanes in each direction. The installation of a new signal is also included at the intersection of Route 20 and Williams Street. The benefits of the project include a lessening of traffic congestion, operational improvements at affected intersections, associated travel time savings, and economic development opportunities.

Double Stack Initiative (Natick and Wellesley): All bridges crossing over the CSX rail line from Natick to Wellesley would be raised to accommodate double stack freight trains. One-half of the cost of this initiative will be funded under the 70% maintenance and improvement program. This project will improve rail access to the Port of Boston and will make the port more attractive in the highly competitive sea freight market. Its benefits include a probable increase in freight business for the port, as well as the possible reduction of truck traffic related to the movement of goods from the port.

Needham Street/Highland Avenue (Newton and Needham): Reconstruction of Needham Street (Highland Avenue) from Centre Street in Newton to I-95 in Needham. The benefits of the project include a lessening of traffic congestion and associated travel time savings.

Burgin Parkway (Quincy): Build a flyover to separate Burgin Parkway from Centre Street and improve access from I-93 to the Crown Colony

Area. The benefits of the project include a lessening of traffic congestion, operational improvements at affected intersections, associated travel time savings, and economic development opportunities.

Quincy Center Concourse, Phase 2: A new two-lane road that connects the Phase 1 bridge and Burgin Parkway with McGrath Highway at Mechanic Street. The benefits of the project include a lessening of traffic congestion, operational improvements at affected intersections, associated travel time savings, and economic development opportunities.

Route 128 Additional Lanes (Randolph to Wellesley): Widening Route 128 from three to four general purpose lanes in each direction between Randolph and Wellesley. The lane volumes for this corridor are the highest on any portion of Route 128. The benefits of the project include a lessening of traffic congestion, operational improvements at affected interchanges, associated travel time savings, and improved safety.

Route 1

I-93/Route 129 Interchange (Reading and Wilmington): This project involves the reconstruction of Route 129 from approximately 800-feet west of Woburn Street in Wilmington east to Causeway Road in Reading. West Street will be relocated 350-feet west of the interchange. Slip ramps will be added to the I-93 interchange. Woburn Street will be realigned at the Route 129 interchange. Route 129 will be reconstructed to provide four 12-foot travel lanes. A median will be in place from 500 feet west of West Street to the end of the project. The benefits of the project include a lessening of traffic congestion, operational improvements at the affected interchange, associated travel time savings, safety improvements, and economic development opportunities.

I-93/I-95 Interchange (Reading and Woburn): This project is planned to improve safety at the junction of I-93 and I-95. The alternative currently under discussion is the construction of a flyover ramp from I-95 south to I-93 south and another flyover from I-95 north to I-93 north. Alterations would be required at some adjacent exits on both interstates, although no specific alternatives have been developed. The benefits of the project include operational improvements at the affected interchange, associated travel time savings, and improved safety.

Mahoney Circle Grade Separation (Revere): Grade separation of Route 1A traffic from Route 16 and Route 60 traffic. The benefits of the project include improved safety, a managing of traffic congestion, operational improvements, associated travel time savings, and enhanced bicycle and pedestrian connections.

Route 1/Route 16 Interchange (Revere): Provide a signal and double left-turn for Route 1 southbound onto Route 16 eastbound. Build ramp between Route 16 westbound and Route 1 northbound. These improvements provide the missing connections at this interchange, allowing much more direct access between Logan Airport and East Boston and locations north on Route 1. The benefits of the project include operational improvements, associated travel time savings, and a reduction of cut-through traffic on local streets.

Route 1A/Route 16 Connection (Revere): Realign Route 16/Revere Beach Parkway and Route 1A to the south and place a 3/4 cloverleaf interchange at the junction. A new signal is

installed on Route 16 providing for left turns between Route 1A southbound and Route 16 eastbound. This design assumes significant redevelopment to commercial and/or residential uses taking place at Suffolk Downs; less expensive designs were identified for smaller scale development. The need for a coordinated, regionwide effort to integrate all the proposed development and infrastructure improvements was recommended in the study. This project, in cooperation with the Route 1/Route 16 project above, improves the connection between Logan Airport/East Boston with Route 1, and upgrades access to development sites all along the Route 1A corridor in East Boston and Revere. The recommended design also includes enhanced bicycle and pedestrian connections in the corridor.

Boston Street (Salem): Widening of Boston Street from Route 107 to Peabody line to three lanes to include a center turning lane. The benefits of this project include operational improvements and improved safety.

Bridge Street (Salem): Widening of Bridge Street from Flint Street to Washington Street Rotary to two lanes in each direction. The benefits of the project include a lessening of traffic congestion, operational improvements, improved access to the commuter rail station, and improved safety.

Bridge Street Bypass (Salem): Construction of a new road along the North River from Veteran's Memorial Bridge to the vicinity of St. Peter Street and Bridge Street. The benefits of the project include a lessening of traffic congestion, operational improvements, associated travel time savings, and improved safety.

Route 18 (Weymouth): Widening of Route 18 to two lanes in each direction. The benefits of the project include traffic congestion management, operational improvements, associated travel time savings, and improved safety. The project also helps facilitate the redevelopment of the South Weymouth Naval Air Station.

Route 3 South Additional Lanes (Weymouth to Duxbury): Widen Route 3 from two to three lanes in each direction from Weymouth to Duxbury. The project also involves design improvements to the interchange ramps at Route 53 in Hanover, Route 139 in Pembroke, and Route 228 in Rockland. The benefits of the project include a lessening of traffic congestion, operational improvements, associated travel time savings, and improved safety.

I-93/Ballardvale Street Interchange (Wilmington): Reconstruction of the existing ramps at I-93 and the construction of new ramps to I-93 in the northeast and southeast quadrants. Route 125 will also be reconstructed in the vicinity of the interchange and the intersection between Route 125 and Ballardvale Street will be altered. The benefits of the project include operational improvements, travel time savings, and improved safety.

New Boston Street Bridge (Woburn): Construct a bridge on New Boston Street at the northern end of the Woburn Industrial Park where New Boston Street crosses the MBTA Lowell Branch commuter rail line. This project would provide an additional means of access to the Anderson Intermodal Center and the Woburn industrial area and will provide improved response time for emergency vehicles to the area.

Transit Projects in the Recommended Plan

Table 10-4 reflects the transit projects that are funded under the 30% capacity program and one project that the MPO assumes will be built with private funding (Assembly Square Orange Line Station). Below is a brief description of each project and a short statement of the benefits of each. The location of each of these projects is shown in Map 10-1.

Arborway Green Line (Boston): Restoration of Green Line E Branch service from Heath Street to Arborway station along South Huntington Avenue, Centre Street and South Street. The implementation of this project is a requirement under the State Implementation Plan (SIP). The primary benefit of the project is the provision of a

TABLE 10-4
Regionally Significant Transit Projects in the Recommended Plan

Total Capital Transit Funds Programmed in the Plan Update:	**$8,734,000,000**	
less **Assumed Discretionary Federal Funds (see, Notes 2 & 3):**	**$875,000,000**	
yields **Funding Currently Available for the Regional Transit System:**	**$7,859,000,000**	
less **Funding Dedicated to Maintenance and Improvement (70%):**	**$5,501,300,000**	
yields **Funding Currently Available for Capacity Improvements (30%):**	**$2,357,700,000**	

	Estimated Cost	Included in model for Air Quality
Transit Projects		
Arborway Restoration (Boston)	**$85,000,000**	**Y**
Fairmount Branch Improvements (Boston)	**$29,600,000**	**Y**
Red Line/Blue Line Connector (Boston) [Note 1]	**$193,000,000**	**Y**
Russia Wharf Ferry Terminal (Boston)	**$5,000,000**	**N**
Silver Line, Phase 3 (60/40)(Boston) [Note 2]	**$950,000,000**	**Y**
New Bedford/Fall River Commuter Rail (Boston to New Bedford)	**$610,000,000**	**Y**
Old Colony/Greenbush Commuter Rail (Boston to Scituate)	**$419,000,000**	**Y**
Medford Hillside Green Line (60/40) (Boston, Medford, & Somerville)[Note 2]	**$375,000,000**	**Y**
Urban Ring, Phase 1 (80/20) (Compact Communities*) [Note 3]	**$100,000,000**	**Y**
100 Additional Buses to Improve Service on Existing Routes	**$38,700,000**	**Y**
Assembly Square Orange Line Station (Somerville) [Note 4]	**$20,000,000**	**Y**

Subtotal Planned Transit Capacity Improvement Costs:	**$2,805,300,000**	
plus **Costs of Ongoing (No-Build) Projects:**	**$425,000,000**	
yields **Total Transit Capacity Improvement Costs:**	**$3,230,300,000**	
less **Assumed Discretionary Federal Funds (see, Notes 2 & 3):**	**$875,000,000**	
yields **Total Funding Currently Available Under the 30% Capacity Program:**	**$2,355,300,000**	

Note 1: This project is currently a legal commitment under the State Implementation Plan (SIP). The MPO has serious doubts about the advisability of funding this project, given the construction of the Silver Line and the Airport Intermodal Connection. The MBTA is undertaking a study of the comparative benefits of these projects and may ultimately pursue a substitution under the SIP. If the substitution is permitted, the MPO will consider amending the Regional Transportation Plan (RTP) to allocate these project funds to other uses, possibly including parking expansion, frequency improvements, Phase 2 of the Urban Ring, or Washington Street light rail service.

Note 2: The MBTA will be seeking federal New Start funding for these projects. The MPO financial plan assumes that 60% of the total project costs will be funded with federal revenues.

Note 3: The MBTA will be seeking federal § 5309 Bus funding for this project. The MPO financial plan assumes that 80% of the total project costs will be funded with federal revenues.

Note 4: The MBTA and the City of Somerville are pursuing private funding for this facility, including the possible use of Transportation Infrastructure Finance and Innovation Act (TIFIA) funds. The use of TIFIA funding for this project would probably necessitate the development of the Assembly Square area as a large, unified project with the new transit station as an integral, non-divisible component. These funds are not included in the Table's subtotal and totals.

*Compact Communities include Boston, Brookline, Cambridge, Somerville, Medford, Everett and Chelsea.

one-seat ride from Forest Hills to Park Street on the Green Line.

Fairmount Branch Improvements (Boston): Upgrade of service on the Fairmount commuter rail line including 15-minute headways, extended hours of service, refurbished existing stations, and the construction of additional stations at South Bay Center, Columbia Road, Mt. Bowdoin, Talbot Avenue, Blue Hill Avenue, and River Street. This project will improve service on the Fairmount Line, which primarily serves low-income and minority communities. It is an attempt to increase the benefits for communities that bear the burden of commuter rail infrastructure.

Red-Blue Connector (Boston): Extend the Blue Line from Bowdoin station to Charles/MGH, providing a transfer between the Red and Blue lines. The extension would be in a tunnel beneath Cambridge Street. The implementation of this project is a requirement under the State Implementation Plan (SIP). However, the MPO has doubts about the advisability of funding this project, given the ongoing and planned construction of the Silver Line and the Airport Intermodal Transit Connector. The MBTA is undertaking a study of the comparative benefits of these projects and may ultimately pursue a substitution under the SIP.

Russia Wharf Ferry Terminal (Boston): Construction of a docking facility and passenger shelter at Russia Wharf near South Station. The facility will provide ferry service between the South Station area and the Charlestown Navy Yard. The implementation of this project is a requirement under the State Implementation Plan (SIP). The primary benefit of the project is the provision of an additional mode option.

Silver Line, Phase 3 (Boston): Construction of a new tunnel through Chinatown and the Leather District in downtown Boston. The tunnel would roughly follow the alignment of Essex Street and would connect Phase 1 of the Silver Line (Washington Street) with Phase 2 (South Boston Piers Transitway) at Boylston Station. Transfers would also be possible with the Orange Line at Chinatown Station. The benefits of this project include the ultimate connection of the phases of the Silver Line into one integrated bus rapid transit system and the ability to transfer directly from the Silver Line to the rapid transit system.

New Bedford/Fall River Commuter Rail (Stoughton to New Bedford): Extension of the Stoughton commuter rail line through Easton, Taunton, and Berkeley, then branching into two lines towards Fall River and New Bedford, respectively. The primary benefit of this project is the provision of an additional mode option for travel between New Bedford/Fall River and Boston. This project will lessen projected vehicle miles of travel in the corridor, reduce associated air pollution, and provide economic development opportunities targeted to a low-income community.

Greenbush Commuter Rail (Braintree to Scituate): Extension of commuter rail from Braintree to Greenbush in Scituate via stops in Weymouth Landing, East Weymouth, West Hingham, Nantasket Junction, and North Scituate. The project will include an 800-foot tunnel section through the center of Hingham. The implementation of this project is a requirement under the State Implementation Plan (SIP). The primary benefits of this project are a lessening of the projected vehicle miles of travel in the corridor, a reduction of associated air pollution, and the provision of economic development opportunities.

Medford Hillside Green Line (Cambridge, Somerville and Medford): Extension of Green Line service from a relocated Lechmere station to Medford Hillside via new stations at Washington Street, School Street, Lowell Street and Ball Square. The extension will be built along the Lowell commuter rail right-of-way. The implementation of this project is a requirement under the State Implementation Plan (SIP). The project will provide an additional mode choice for residents of Somerville and Medford. It is an attempt to increase the benefits for communities that bear the burden of transit infrastructure.

Urban Ring, Phase 1 (Boston): New express bus routes are added. Crosstown bus routes are

extended and additional routes are implemented. This project provides bus connections for radial travel in the Urban Ring corridor (Boston, Brookline, Cambridge, Somerville, Medford, Everett and Chelsea). Its benefits include the provision of an additional mode option, travel time savings, a reduction in air pollution, and the diversion of passengers from the overloaded downtown transfer stations.

100 Additional Buses (Regionwide): Procure 100 additional (not replacement) alternative fuel buses for use on congested bus routes.

Assembly Square Orange Line Station (Somerville): New Orange Line station located at the eastern edge of the Assembly Square development area. This is an intermediate station between Wellington and Sullivan Square intended to facilitate higher density redevelopment of the Assembly Square area. This project will provide an additional mode option for residents of Somerville. It is an attempt to increase the benefits for a community that bears the burden of transit infrastructure. Another primary benefit of this project is to facilitate the transit-oriented development of one of the largest developable parcels in the Inner Core.

As mentioned earlier, the MPO used various sources of information to inform its decision-making, but was not overly influenced by any single factor. Ultimately, a regional transportation plan is guided by the professional judgment of the appointed policy-makers. The result is a list of recommended projects that the MPO believes will help implement the long-range vision implicit in the transportation policies adopted by the MPO.

Pedestrian safety

One example of the influence of these sources of information on the final project list can be found in the work of the Environmental Justice Ad Hoc Committee. The committee placed a priority on securing funding for two projects, the purchase of 100 additional buses and the institution of light rail service on Washington Street. The committee also supported the following projects as included in various working drafts of the Plan Update: the restoration of Green Line service to Arborway, the extension of Green Line Service to Medford Hillside, and the improvement of service on the Fairmount Line. The Green Line projects are requirements of the State Implementation Plan, while the Fairmount Line project is based, in part, upon the work of the MBTA Advisory Board, an MPO member. The Advisory Board, the MBTA, the City of Boston and a large, representative group of community residents have been working together for over a year to study and plan improvements to the Fairmount Branch. The community residents of Four Corners, Mattapan, Codman Square, and South Bay strongly support this project and feel that the Fairmount Branch improvements are consistent with the goals of the Environmental Justice Ad Hoc Committee. The Plan Update's recommended list of projects includes these projects as well as the procurement of 100 additional buses as recommended by the Environmental Justice Ad Hoc Committee. The institution of light rail on Washington Street is included in the Plan Update as an illustrative project that might be pursued in future iterations of the Regional Transportation Plan.

The Washington Street project is a good example of the interplay between the various sources of project information. Advocacy groups from the affected neighborhoods have spoken in favor of

light rail and in opposition to bus rapid transit (the Silver Line). Yet, the federal government is clearly encouraging transit agencies and MPOs to consider bus rapid transit as a less costly alternative to conventional light rail or heavy rail projects. In the case of Washington Street, the MBTA and the City of Boston are convinced that the Silver Line could greatly improve the transit mobility of the affected communities. This opinion is supported by MPO modeling results and project-specific analysis. The MPO has, therefore, opted to not include the Washington Street light rail project at this time, but has, at the urging of the City of Boston, included it as an illustrative project so that the needs of the corridor will continue to be analyzed by the MPO in the near term.

Specifically, the MPO is committed to monitoring the implementation and operation of Phase 1 of the Silver line (Washington Street) for compliance with its service commitments. If the bus rapid transit service operates as promised and achieves transit-type headways, then there is little to no transportation justification for light rail on Washington Street. If however, as the Ad Hoc Committee expects, it proves impractical or impossible to provide such service on city streets in mixed traffic, then the MPO will work with the community and the MBTA to provide an appropriate level of service, quite probably including light rail on Washington Street.

The MPO also expects that the Washington Street Light Rail Project will be included in all reviews and analyses related to the ongoing development of the Program for Mass Transportation (PMT). The PMT, which is the MBTA's long-range capital planning document, is currently under development. One of the most important components of the PMT is the development of a set of criteria to measure the anticipated benefits from all proposed expansion projects. Benefits may include variables such as number of riders, number of new riders (as opposed to diversions from the current system), air pollution reduction, travel time savings, and other performance measures. In accordance with the Memorandum of Understanding (MOU) governing the operation of the Boston Region MPO, the PMT will be one of the primary source documents for the development of future iterations of the Regional Transportation Plan.

In addition to including projects that provide benefits for low-income and minority communities, the MPO is committed to ensuring that projects will not unduly burden these communities. To that end, the MPO has adopted policies to ensure equitable treatment in the implementation of transportation policies, programs, and projects. All projects under consideration for inclusion in the Plan Update were reviewed for conformity with this policy. The MPO is also currently developing criteria for project selection for the Transportation Improvement Program (TIP). The TIP is the MPO's short-range capital programming document. The programming criteria being developed will be tied to the Regional Transportation Plan policies, including those relating to environmental justice.

Maintenance and Improvement Projects

Most of the work of the MPO in the future will be devoted to the maintenance and improvement of its existing infrastructure. For the most part, this work does not add capacity to the system. Rather, it extends the life or modernizes existing components of the system or provides capital enhancements that improve operations. These types of projects are funded under the 70% of revenues (highway and transit) that the MPO has reserved for maintenance and improvement of the existing system and are not specifically listed in the regional transportation plan.

Bridge maintenance and rehabilitation: Over the next twenty-five years, the MPO will need to fund the maintenance of the region's bridges. This includes replacing bridge decks, reconstructing bridges, painting bridges and performing other routine or periodic maintenance. Where appropriate, such as the Boston to Worcester corridor, bridge maintenance and rehabilitation will include providing sufficient vertical clearance to permit double-stack freight movement. A new bridge providing a connection that does not currently

exist would be considered a regionally significant project and must be listed in Tables 10-1 and 10-3.

Interstate maintenance: MassHighway oversees the interstate maintenance program and ensures that the system of interstate highways within the region are maintained to an acceptable standard. Work under this category includes reconstruction, resurfacing, signage, striping and other routine or periodic maintenance.

Pavement maintenance: MassHighway maintains an ongoing pavement management program to rate the serviceability of the pavement of the region's roadways. Pavement maintenance may be accomplished through surface patching, roadway resurfacing, or full-depth reconstruction.

Safety: Safety projects address specific roadway safety issues identified through data analysis performed by the MPO and MassHighway. Safety projects include a hazard elimination program, shoulder improvements, and intersection realignments. The MPO maintains a GIS database of crash locations and is able to rank intersections or stretches of roadway most in need of improvement. These rankings are done for motor vehicle, bicycle, and pedestrian modes.

Intersection/signal improvements: This category includes intersection channelization projects, signal upgrades, and realignments. This category does not include intersections or segments of roadway that add additional roadway capacity or signals that are coordinated along a corridor. Capacity adding projects are subject to air quality conformity analysis and must be specifically identified in Tables 10-1 and 10-3.

Enhancement Projects: The MPO will continue to fund various types of transportation enhancement activities including but not limited to acquiring scenic easements, preserving historic transportation infrastructure and providing landscaping, streetscaping and other beautification projects.

Bicycle and pedestrian projects: The MPO will continue to fund trails, pedestrian amenities and other enhancement projects. Improvements for bicycists and pedestrians are a routine aspect of roadway reconstructions. Five bicycle and pedestrian trails are included in the recently adopted Fiscal Years 2002–2007 Transportation Improvement Program and several others are in various stages of planning.

Transportation Demand Management (TDM): TDM strategies will continue to be implemented and funded within the region. This includes both capital and operating measures. Project funding has included shuttle services, park and ride lots, and bicycle projects. Currently, there are twelve

TABLE 10-5
The MBTA Planned Parking Program

Line	New Spaces	Cost
Newburyport/Rockport Commuter Rail	2,032	$49,400,000
Haverhill Commuter Rail	546	$14,500,000
Lowell Commuter Rail	609	$15,500,000
Fitchburg Commuter Rail	858	$27,700,000
Worcester Commuter Rail	565	$7,000,000
Franklin Commuter Rail	500	$6,000,000
Attleboro/Providence Commuter Rail	930	$20,000,000
Plymouth/Kingston Commuter Rail	550	$6,000,000
Middleborough/Lakeville Commuter Rail	500	$7,000,000
Red Line	1,928	$30,300,000
Green Line	550	$10,000,000
Total	**9,568**	**$193,400,000**

Transportation Management Associations within the region working to provide commuters with alternatives to driving alone. As the roadway network becomes more congested, the importance of more efficiently managing the use of the roadways will become even more critical.

Intelligent Transportation Systems (ITS): ITS has been employed and will continue to be employed by Boston Region MPO transportation agencies. The Massachusetts Turnpike Authority has instituted the FastLane program. Massport has instituted an automated vehicle identification system to improve revenue control at its parking facilities; has installed closed circuit television to improve security, assist with incident detection and provide enhanced curbside management; and has installed variable message signs to improve landside traffic information. The MBTA is in the process of instituting an Automated Fare Collection (AFC) system and is constructing a state-of-the-art bus control center. MassHighway is developing a statewide ITS protocol and has installed variable message signs on selected routes.

Suburban Mobility Improvement Program: The program funds would be used for capital equipment and other capital related expenditures of HOV services and programs that improve the mobility of residents in areas currently unserved or underserved by transit. This program would operate mostly in suburban areas of the MPO region not currently served or underserved by fixed-route bus services. The program's design would be flexible to allow for both the acquisition of capital equipment or for the leasing costs associated with capital equipment from an already established transportation service provider, so as to realize the most cost-effective utilization of equipment based on the needs of specific area residents and workers.

Potential services associated with this program (for which capital costs would be eligible), include fixed route shuttles serving markets not typically addressed (i.e. suburb to suburb, reverse commute, etc.), employer-based van/car pool services, and flexible (or "deviated") route shuttle services.

Eligible applicants would be local or regional public entities, recognized Transportation Management Associations serving the region, or other approved non-profit entities capable of implementing such projects. Project proposals would be reviewed based on a set of specific criteria to be applied by a review committee. Matching requirements would adhere to all federal requirements and include the provision of a 20% non-federal match.

Parking: The MPO is committed to increasing the available parking capacity at various commuter rail and transit stations throughout the region. Unlike most of the other projects funded under the 70% maintenance and improvement program, the addition of parking spaces to the public transportation system is included in the regional travel demand model. The MBTA's current long-range plans envision adding over 9,500 spaces at a cost of approximately $193.4 million as outlined below in Table 10-5. The MBTA anticipates using myriad funding sources for these projects including federal funds allocated to the MBTA, federal funds allocated to other RTA's for use on the commuter rail system; and federally earmarked, MBTA, local, private, and state bond funds.

Track, Signal and Right of Way maintenance: The MBTA must maintain its track, signals and rights-of-way in good working order. Scheduled projects over the next five years will include track and signal work on the Orange Line.

Vehicle procurement: The MBTA must maintain a schedule of rehabilitation and replacement of its vehicle fleet. New low floor Green Line cars and new Blue Line cars are two examples. Each of these procurements cost over $120 million. The MBTA is also in the process of purchasing low-emission buses.

Vehicle rehabilitation: This category includes the refurbishing transit service vehicles to extend their useful life or retrofitting current equipment to reduce air pollutants. Vehicle rehabilitation currently underway includes the Mattapan High

Speed Line Presidential Conference Committee cars, commuter rail cars and diesel buses.

Station modernization: The MBTA has a modernization program to maintain and update transit stations. All Blue Line stations from Wood Island to Wonderland, with the exception of Orient Heights, have been modernized within the past five years. Aquarium Station is currently under construction in conjunction with the Central Artery project. The four stations on the Ashmont branch of the Red Line are in the early stages of modernization.

Public Transportation Accessibility: The MBTA is working toward full compliance with the Americans with Disabilities Act (ADA). Current and future work will focus on bringing the Green Line (vehicles and stations) and the few remaining Red Line stations along the Ashmont branch into compliance. In many cases, station modernization programs incorporate the provision of accessibility. An example of this is the Blue Line station modernization program currently underway.

Illustrative Projects

The Boston Region MPO has identified several additional major capital projects that could significantly contribute to improved mobility in the region. These projects are not currently included in the recommended plan because there is not now sufficient revenue to fund them. If funds become available for one or more of these projects, they may be included in a future update of the Plan. The MPO's "illustrative" projects, with their current status report, are provided below. For detailed descriptions of these projects, as well as the No Build and Base Case projects included in the Plan Update, see Appendix F.

Urban Ring, Phases 2 & 3: In July 2001, the MBTA filed an Expanded Environmental Notification Form with MEPA and a Notice of Intent with FTA for a Special Review Procedure for implementation and environmental review of the Urban Ring project in three phases. The phases were requested in recognition of the cost and long lead requirements associated with vehicle procurement, design and construction of busways, intelligent transportation features, maintenance facilities and rail components. Each phase would build upon the previous one while continually expanding the level of service in the Urban Ring Corridor. Phase 1, the enhancement of express and circumferential buses in the corridor, is included in the recommended list of projects in Tables 10-1 and 10-3. During Phase 2, commuter rail connections and Bus Rapid Transit service incorporating a combination of separate right-of-way, bus lanes and ITS features would be added. Finally, light or heavy rail service would be added during Phase 3. Work is now progressing in identifying potential sites for the maintenance of the additional buses required for Phase 1 service and on the Draft Environmental Impact Report and Environmental Impact Statement for Phase 2 of the project. The amount of funding available at the time of the development of this Plan, as well as the long lead time before the MBTA moves forward with the later phases, resulted in the omission of Phases 2 and 3 from the Plan Update. However, the Boston Region MPO is committed to improving circumferential transit in the inner core. The MPO recognizes the travel time savings, reduced transfers, increased mobility and improved access to jobs for low income and minority residents in the Corridor, and reduction in central subway congestion provided by the completed phases of the Urban Ring. Therefore, the MPO will continue to seek funding for later phases of the Urban Ring in future iterations of the Regional Transportation Plan.

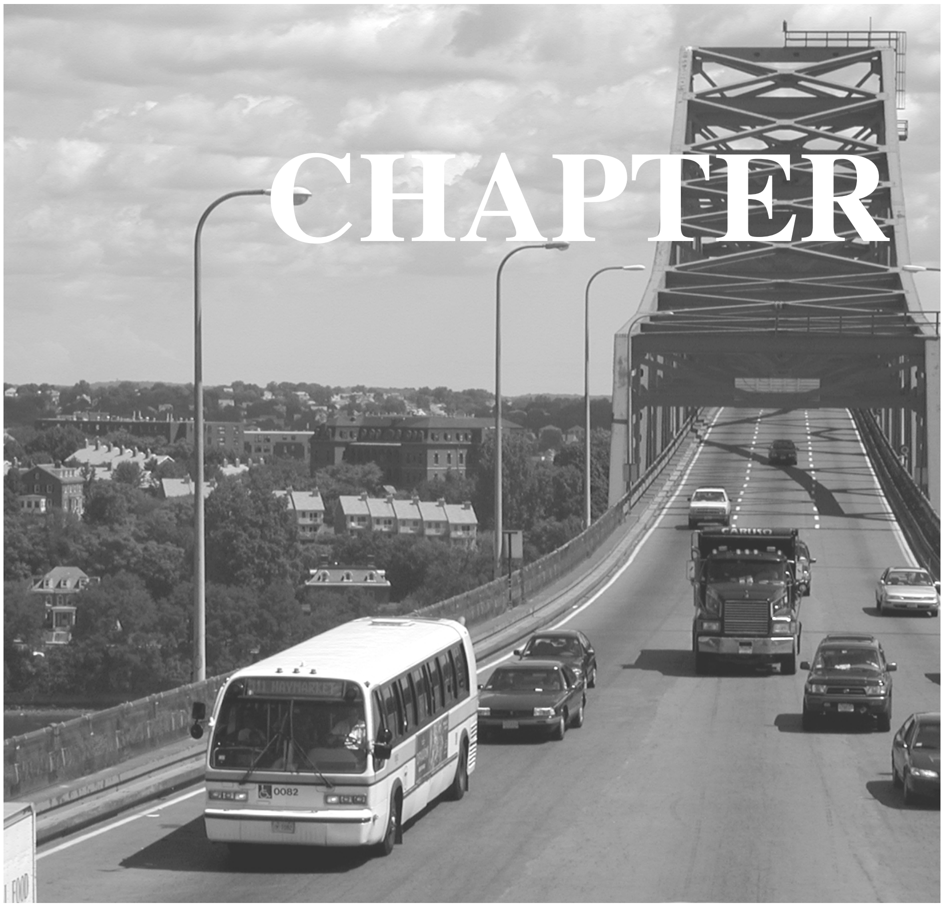
North-South Rail Link: This project would link North and South Stations in downtown Boston. The MBTA is continuing work on a Major Investment Study (MIS) in conjunction with a Draft Environmental Impact Statement (DEIS) and Draft Environmental Impact Report (DEIR). The MBTA currently projects the release of these documents in 2002. New ridership projections based on the revised transportation demand model and final cost estimates are being developed as part of the MIS. A lack of funding and the ongoing status of the North-South Rail Link's environmental and financial studies prevented the MPO from includ-

ing the project at this time. However, the Boston Region MPO recognizes the potential benefits of the Rail Link to intercity rail travelers, suburban commuter rail passengers, and users of the MBTA's core subway system and will continue to explore possible financing options while closely monitoring the MIS/DEIS/DEIR process in 2002.

Light Rail on Washington Street: The MBTA is currently constructing replacement service for the elevated Orange Line (removed in 1987) along Washington Street in Boston in the form of the new Silver Line Bus Rapid Transit (BRT) system. Several groups from the Roxbury district of Boston, the location of the Silver Line's Dudley Square terminal, have requested that the MBTA use light rail vehicles along the corridor instead. The Boston Region MPO's Environmental Justice Ad Hoc Committee recommended inclusion of this project as one of its highest priorities. The Boston Region MPO values highly the input of the Environmental Justice Ad Hoc Committee, but also supports the MBTA's suggestion that BRT systems have the potential to carry passengers as quickly and efficiently as light rail vehicles at a lower cost. The fact that the current construction of the Silver Line does not prevent a future change of the service to light rail, coupled with current financial constraints, has convinced the MPO that the BRT system should be implemented and evaluated before additional resources are used for light rail. When work begins on the next iteration of the Regional Transportation Plan, the Boston Region MPO will have much more information on the operational capabilities of BRT on the Washington Street corridor.

Each of these projects have long lead times for implementation and could be completed, at the earliest, well after the next federally-required update of the Plan, which will occur within the next three years. The examples given are all major transit projects. The MBTA is currently developing its new long-range capital plan for transit—the Program for Mass Transportation (PMT). Once the PMT process is complete, both the MBTA and the MPO will have more information on the ability of these three projects, as well as numerous others not listed, to improve the efficiency of the region's transit system.

Simultaneous with the development of this Plan and ongoing PMT work, EOTC, the MBTA and MassHighway have been directing the study and evaluation of several other projects and initiatives throughout the region. As these studies are completed, additional projects may be recommended to the MPO for inclusion in the next Transportation Plan. Moreover, the region's Congestion Management System will continue to identify projects and strategies that may need to be reflected in future iterations of the Transportation Plan.



CHAPTER 11

FORECAST OF 1995 BASE CASE AND 2025 BUILD SCENARIOS

To develop the Transportation Plan Update, it was necessary to conceptualize the region's transportation needs over the next 25 years. Land use patterns, growth in employment and population, and trends in travel patterns all create different demands on the region's transportation system. In order to estimate future demands on the system for this Update, the MPO utilized a regional travel-demand forecast model. The model is a planning tool used to evaluate the impacts of transportation alternatives given varying assumptions with regard to population, employment and land use, etc. as described below. The model also can be used to assess potential projects in terms of air quality benefits, travel times, and congestion reduction.

TRAVEL DEMAND MODEL CHARACTERISTICS

The travel model set in this report simulates existing travel conditions and forecasts future-year travel on the eastern Massachusetts transit and highway system. To get a more accurate picture of the travel demands in the Boston region, the Eastern Massachusetts Regional Planning Project (EMRPP) area is used. The EMRPP region includes an additional 63 communities outside of the 101-municipality Boston Region MPO. It encompasses communities east of Worcester, north to the New Hampshire border and south to portions of Bristol and Plymouth counties (see Map 11-1).

The model contains all MBTA rail and bus lines, all private express bus carriers, all express highways and principal arterials, and many minor arterials and local roadways. The region is subdivided into almost one thousand traffic analysis zones. The model set simulates transportation supply characteristics and transportation demand between every zone to every other zone. This simulation is the result of several inputs, the most important of which are population, employment, auto ownership, transit fares and automobile costs, and highway and transit levels of service. These inputs are updated on a regular basis to ensure the reliability of the forecasts. The model set, which is similar in nature to those used in most

Map 11-1
Eastern Massachusetts Regional Planning Project Rings

other large urban areas in North America, also incorporates many new procedures, including the ability to forecast non-motorized trips.

The travel model analysis for the Transportation Plan Update consisted of several steps. First, an existing conditions network was tested to simulate recent (1995) travel conditions. Then a future No-Build alternative was coded and modeled. The No-Build alternative assumed that only those improvements noted in the No-Build section of this chapter will be made between 1995 and the year 2025. It provided a baseline against which the predicted effects of potential future investments in the transportation system were measured.

The forecast for the No-Build used the 2025 demographic data developed by MAPC using the Targeted Growth scenario assumptions. Next, as discussed in Chapter 2, three alternative sets of projects were compared to the 2025 No-Build scenario. Then, these results and other measures, including policies and public comments, were reviewed. A final set of projects was recommended, coded and modeled. Using the No-Build analysis as a point of reference, the statistics helped to measure the effectiveness of each future action alternative. Several important travel statistics were summarized for each of these model runs, including:

- Total vehicle miles of travel (VMT) and vehicle hours of travel (VHT) on a typical weekday.
- Average speed of highway traffic.
- Amount of air pollution produced by automobile and transit vehicles.
- Total number of daily trips made by auto and transit.
- Average daily transit ridership by mode (bus, subway, commuter rail, etc.).
- Percentage of people traveling by each of the travel modes.
- Average trip length for transit and auto trips.

Selected model data results from the three test alternatives are included in Appendix D.

Base Case, No-Build and Build Assumptions

The travel demand model used the year 1995 as a starting point for model analysis. This was the latest year that the MPO had a depth of reliable data for model inputs. Projects included for analysis were "regionally significant" as defined by the federal government. They were regional in nature, added capacity and had air quality impacts as measured by the model. The selected projects were grouped into three categories: 1995 Base Case Scenario, 2025 No-Build, and 2025 Build. Descriptions of the 1995 Base Case and 2025 No Build projects are included in Appendix F. Project description of the 2025 Build projects were included in Chapter 10. Project descriptions of Capital investments not affecting the travel model are also included in Appendix F.

1995 Base Case Scenario

The 1995 Base Case consists of those major roadway and transit projects that were open for public use by December 31, 1995. Their attributes were coded into the model to serve as the starting point for analysis.

1995 Base Case Scenario Projects

Highway

Route 53, Phase I (Hanover)

HOV Lane on I-93 (Mystic Avenue)

HOV Lane on the Southeast Expressway

Ted Williams Tunnel

South Boston Bypass Road

Transit

Urban Ring Crosstown Bus Service

Worcester Commuter Rail, Partial Service

Additional Park and Ride Spaces

South Station Transportation Center

2025 No-Build Scenario

The 2025 No-Build scenario consists of those projects that opened for public use after January 1, 1996, and those that are under construction or have been advertised for construction. Only those projects that the MPO felt were far enough along in the programming and construction process were included in this list.

2025 No-Build Scenario Projects

Highway

Central Artery

Beverly Salem Bridge

Blue Hill Avenue Signal Coordination

Brighton Avenue Signal Coordination

Route 139 (Marshfield)

Route 20 (Marlborough)

I-495 Interchange (Marlborough/Southborough)

I-93 Industriplex Interchange (Woburn)

Quincy Center Concourse, Phase 1

Route 62 and Middlesex Turnpike

Route 9 (Wellesley)

Marrett Road Signal Coordination (Lexington)

Route 138 (Canton)

Route 38 (Wilmington)

Route 1 and Associated Improvements (Foxboro)

Route 3 North

Transit

Commuter Boat Service in the Inner Harbor

Newburyport Commuter Rail Service

Old Colony Commuter Rail (two lines)

Additional Park and Ride Spaces

North Station Improvements

Blue Line Modernization

Worcester Commuter Rail, full service

Silver Line – Transitway, Phase 1

Silver Line – Washington Street, Phase 2

Mattapan Refurbishment

Amtrak Northeast Corridor Electrification

Airport Intermodal Transit Connector

Industriplex Intermodal Center (Woburn)

Route 128 Amtrak Station

2025 Build Scenario (Recommended Plan)

The 2025 Build scenario consists of those new regionally significant projects endorsed by the Boston Region MPO for inclusion in the Transportation Plan Update.

2025 Build Scenario Projects

Highway

Crosby Drive (Bedford)

Middlesex Turnpike (Bedford/Burlington)

Rte. 128 Capacity Improvements (Beverly to Peabody)

East Boston Haul Rd./Chelsea Truck Route (Boston)

Route 1A/Boardman St. Grade Separation (Boston)

Rutherford Avenue (Boston)

Double Stack Initiative (Boston)

Massachusetts Avenue/Lafayette Sq. (Cambridge)

Cambridgeport Roadways (Cambridge)

I-93/I-95 Interchange (Canton)

I-95 (NB)/Dedham St. Ramp (Canton)

I-95 (SB)/Dedham St. Onramp (Canton)

Concord Rotary (Concord)

Route 2/Crosby's Corner (Concord)

Route 1/114 Corridor Improvements (Danvers &Peabody)

Telecom City Roadways (Everett, Malden, & Medford)

Revere Beach Parkway (Everett, Malden, & Revere)

Route 126/Rte. 135 Grade Separation (Framingham)

Route 9/Rte. 126 Interchange (Framingham)

Double Stack Initiative (Framingham to Worcester)

Route 140 (Franklin)

Route 53 (Hanover)

Route 53/Rte. 228 (Hingham & Norwell)

Naval Air Station Access Improvements (Hingham, Rockland &Weymouth)

I-495/I-290/Rte. 85 Interchange (Hudson &Marlborough)

Route 128 Capacity Improvements (Lynnfield to Reading)

Route 1 Improvements (Malden & Revere)

Route 20, Segments 2 & 3 (Marlborough)

Double Stack Initiative (Natick to Wellesley)

Needham St./Highland Ave. (Needham & Newton)

Burgin Parkway (Quincy)

Quincy Center Concourse, Phase 2 (Quincy)

Route 128 Additional Lanes (Randolph to Wellesley)

I-93/Route 129 Interchange (Reading & Wilmington)

I-93/I-95 Interchange (Reading & Woburn)

Mahoney Circle Grade Separation (Revere)

Route 1/Route 16 Interchange (Revere)

Route 1A/Route 16 Connection (Revere)

Boston Street (Salem)

Bridge Street (Salem)

Bridge Street Bypass (Salem)

I-93/Mystic Avenue Interchange (Somerville)

Route 18 (Weymouth)

Route 3 Additional Lanes (Weymouth to Duxbury)

I-93/Ballardville Street Interchange (Wilmington)

New Boston Street Bridge (Woburn)

Transit

Arborway Restoration (Boston)

Fairmount Branch Improvements (Boston)

Red Line/Blue Line Connector (Boston)

Russia Wharf Ferry Terminal (Boston)

Silver Line, Phase 3 (Boston)

New Bedford/Fall River Commuter Rail (Boston to Bedford)

Old Colony/Greenbush Commuter Rail (Boston to Scituate)

Medford Hillside Green Line (Boston, Medford & Somerville)

Urban Ring, Phase 1 (Inner Core)

Park & Ride (Regionwide)

Assembly Square Orange Line Station (Somerville)

100 Additional Buses (Regionwide)

Model Results and Interpretations

The differences in systemwide performance indicators between the Build and No-Build scenarios

are dwarfed by the changes projected to occur between now and 2025 in the region. However, the differences described by the model resulting from the choice of Build or No-Build are well within what would be expected and they do represent some very real benefits that would accrue as a result of the transportation investments contemplated. It is very difficult, looking at an entire transportation system that is forecast to serve 17 million trips, to perceive much change in most of the systemwide performance indicators, particularly with a transportation system as large and built-out as the Boston Region. However, significant changes in performance can be seen when these statistics are examined on a facility or corridor basis. After all, transportation investments are made to address a transportation need in a particular geographic area. Some of this corridor-level information is provided in Table D-3 in Appendix D. Understanding the regional impacts of a package of investments is still informative, however, and the impacts forecast by the model follow.

Increase in Trips

The new 2025 Targeted Growth Forecast projects significant increases in the number of employees and residents in the EMRPP region. As indicated in Table 11-1, this growth (25% for households and 31% for employment in 2025) is expected to be greatest in the center (Downtown Boston) and in the outer portions (Rings 3 and 4). The rings are illustrated in Map 11-1. As indicated in Table 11-2, the average household size and number of workers per household are expected to fall, while the average household income is expected to rise slightly. The Auto Ownership Model indicates that this combination of socioeconomic changes will result in a slight decrease in the average number of vehicles per household. However, the total number of vehicles in the region will increase because the number of households will increase.

This growth in households and employment leads to substantial increases in the number of trips produced by, and attracted to, the region on an average weekday. As indicated in Table 11-3, the number of trips is expected to increase by 26% between 1995 and 2025. The biggest increases are expected in Downtown Boston (Ring 0), the outer portion (Ring 4), external zones (areas just outside of the region). Non-home-based trips (where the traveler's residence is not the origin or destination) are expected to increase more than home-based trips.

Table 11-4 presents a breakdown of trip growth by mode. Total intraregional person-trips within the model are projected to increase from 14.2 million per day in 1995 to 17.5 million in 2025. As indicated in Table 11-4, transit and nonmotorized (walk/bicycle) trips are expected to grow at a faster rate than auto trips. Transit trips increase from 776,000 in 1995 to 1.22 million for 2025 No-Build and 1.26 million for 2025 Build. These increases represent growth of 57.8% and 62.8%, respectively. Trips made by auto show a lower proportional increase from 11.2 million in 1995 to 13.1 million (or approximately 18%) for either the 2025 No-Build and Build scenarios. Nonmotorized trips are projected to increase from 2.2 million in 1995 to 3.20 million for 2025 No-Build (a 43% increase) and 3.17 million for 2025 Build (a 42% increase).

The MPO has selected its highway projects, in large part, to address the projected growth under the No-Build scenario. Using the transportation model data, information from the Congestion Management System, and findings from individual studies, the MPO has identified locations where improvements to the existing system would help to ease the projected congestion. It is not the MPO's intent to encourage or facilitate growth in single-occupancy vehicle travel beyond that which is projected in the No-Build scenario. In fact, with capacity improvements provided in the Plan under the Build scenario, projections in intraregional auto trips show a decrease of 9000 person-trips per day compared to the No-Build scenario, as shown in Table 11-5.

Changes in Transit Ridership

In order to determine the true level of transit demand given the underlying population and

employment projections, the transit ridership forecasts presented by the regional travel forecasting model are not constrained by transit service capacity. As a result, the ridership growth projected by the model will in a number of cases exceed the passenger capacity of the buses and trains in service.

The above section notes that transit system linked trips would increase by more than 38,000 in the Build scenario versus No-Build. That represents a benefit to the region's travelers, particularly when considering the amount of transit investment in the No-Build that would already have captured additional transit riders even without the Build scenario investments.

Another sign of the success of these investments is the mode share for transit. As indicated in Table 11-4, the transit mode share increases from 5.5% in 1995 to 7.0% for 2025 No-Build, and 7.2% for 2025 Build. This is an increase of or about 38,000 riders from the No-Build to the Build scenario. The Greenbush line and New Bedford/Fall River line in the Build scenario would attract many riders from the automobile mode. The shift from walk mode is due primarily to two transit projects. One of these is the Red Line/Blue Line connector, which is designed to obviate both excessive transferring as well as walking between stations for travelers using both lines to accomplish a trip. The Silver Line project would also obviate many walk trips between the financial district and the Fan Piers area. The increase in transit ridership will not affect each transit mode equally. With the largest growth expected in the outer portions of the region and the Downtown Boston area, commuter rail ridership growth is forecasted to be substantial (148% for 2025 No-Build and 155% for 2025 Build). Rapid transit ridership growth is also expected to be large (68% for 2025 No-Build and 53% for 2025 Build). Table 11-6 shows that among the rapid transit lines, the largest growth in ridership from 1995 to 2025 is expected on the Red Line. All the other lines are also projected to grow at a significant rate. This growth in rapid transit ridership may also exceed available capacity. As shown in Table 11-6, the increase in ridership on the rapid transit lines will be greater in the No-Build than the Build. This is due to the Urban Ring project in the Build shifting riders from the existing rapid transit lines.

The forecast transit ridership results derived from the model are not constrained by parking lot capacities. For the 2025 Build scenario, transit station parking demand will exceed parking supply by as many as 30,000 spaces. This is an issue that the MPO has begun to address by including funding for additional park and ride spaces in this Update.

In addition, although not reflected in these statistics, the added transit capacity in the 2025 Build scenario would have the added benefit of helping to serve what is projected to be excess transit demand (that exceeding available supply) in the 2025 No-Build scenario. The quality of a transit ride is also affected by the investments made in the Build scenario. The transfer rate for transit trips would decrease slightly. This represents a benefit for transit riders since transferring is perceived as onerous. It reflects the fact that new services such as the Silver Line, Airport Intermodal Transit Connector (AITC), Green Line-Medford Hillside, the Blue Line/Red Line Connector, and the Urban Ring would allow passengers to reach their destinations without having to make as many transfers.

Effects on Auto Travel

Even with auto travel growing at a slower rate than transit, roadway vehicle miles traveled (VMT) are projected to increase. Table 11-5 shows that VMT growth will be 32% for both the 2025 No-Build and the 2025 Build. Due to increases in congestion, average speeds will decline from 32.6 MPH in 1995 to 29.9 in the No-Build scenario and 30.3 in the Build scenario. Roadway improvements in the Build scenario will help to allow increased average speeds over the No-Build scenario.

The VMT for the Build scenario will be slightly higher than for the No-Build. This results from the factor that underlies the Build scenario's aver-

age auto trip length which is one-tenth of a mile greater than the No-Build scenario. This results because travelers in large urban areas usually seek to minimize their travel time. Many highway improvements, such as added freeway capacity, will divert travelers from shorter distance surface street routes to longer distance but faster routings over the newly improved roadway. If enough of this kind of route diversion occurs, the systemwide average auto trip-length can increase slightly. This is exactly what will occur in the Build scenario in association with its numerous highway improvement projects.

Finally, it should be noted that there is a "disequilibrium" underlying the future transportation system as modeled. That is, we have modeled the probable impacts on the transportation system of a particular set of demographic forecasts, but we have not done the opposite. We have not fully accounted for the influence that transportation system characteristics might have on the previously prepared demographic forecasts. While the demographic forecasts did take into account future transportation investments in a general sense, they could not fully account for the specific pattern of transportation impacts that this particular set of investments is likely to exhibit. So, for example, if a particular travel corridor within the region is forecast with the Build network scenario to experience higher levels of congestion than a nearby corridor, then the former may experience somewhat less population and employment growth than had been previously forecast. Similarly, the less congested corridor may experience somewhat more growth. This shifting of growth from one area to another would most likely occur because households and businesses do take transportation times and costs into account when deciding on location.

It is not clear to what extent this lack of a "feedback loop" from the travel forecasts back to the demographic forecasts might affect the travel forecasts. It can only be said that there is probably some effect, and that it may appear as a slight overstatement of congestion levels in some corridors. In the larger context of the demographic forecasts, though, this effect should not be too worrisome. That is because the demographic forecasts, although done with reference to general patterns of future water and sewer infrastructure availability, could not fully account for the specific future locations of such investments, and in consequence, those forecasts may not be exact in certain specific locations. There are also other sources of error in any set of demographic forecasts. The exact location of all future new development simply cannot be known. To conclude, although the lack of a feedback loop between the demographic and travel forecasts bears mentioning, there are other factors that affect the demographic forecasts as well. This particular factor should not be considered to be too serious.

For further details on the model results for the various transportation and land use networks, see Appendix D.

TABLE 11-1
Travel Model Results

Socioeconomic Characteristic	1995	Targeted Growth 2025	% Growth 1995-2025
Households	1,544,114	1,927,374	24.8
Ring 0	86,447	115,453	33.6
Ring 1	287,973	339,797	18.0
Ring 2	289,378	338,453	17.0
Ring 3	443,912	549,313	23.7
Ring 4	436,404	584,358	33.9
Total Employment	2,133,930	2,799,729	31.2
Ring 0	432,713	588,522	36.0
Ring 1	285,901	378,373	32.3
Ring 2	341,881	439,008	28.4
Ring 3	628,321	806,778	28.4
Ring 4	445,114	587,048	31.9
Basic Employment	673,401	646,010	-4.1
Ring 0	82,922	80,034	-3.5
Ring 1	59,164	65,516	10.7
Ring 2	105,041	86,038	-18.1
Ring 3	232,856	225,449	-3.2
Ring 4	193,418	188,973	-2.3
Retail Employment	295,787	448,802	51.7
Ring 0	35,983	50,736	41.0
Ring 1	36,195	48,843	34.9
Ring 2	46,487	63,698	37.0
Ring 3	107,198	159,241	48.5
Ring 4	69,924	126,284	80.6
Service Employment	1,164,742	1,704,917	46.4
Ring 0	313,808	457,752	45.9
Ring 1	190,542	264,014	38.6
Ring 2	190,353	289,272	52.0
Ring 3	288,267	422,088	46.4
Ring 4	181,772	271,791	49.5

TABLE 11-2
Travel Model Results

	1995	2025 No-build	% Growth 1995-NB	2025 Build	% Growth 1995-2025
Population	4,160,100	4,834,000	16.2	4,834,000	16.2
Households by HH Size	1,544,114	1,927,374	24.8	1,927,374	24.8
1 person	401,904	626,274	55.8	626,274	55.8
2 people	471,997	532,896	12.9	532,896	12.9
3 people	269,885	333,744	23.7	333,744	23.7
4 people	236,647	260,278	10.0	260,278	10.0
5+ people	163,681	174,182	6.4	174,182	6.4
Avg HH Size	2.604	2.508	-3.7	2.508	-3.7
Households by HH Income	1,544,114	1,927,399	24.8	1,927,399	24.8
< $20,000	371,217	458,131	23.4	458,131	23.4
$20-40,000	397,738	492,063	23.7	492,063	23.7
$40-60,000	335,194	419,324	25.1	419,324	25.1
> $60,000	439,965	557,881	26.8	557,881	26.8
Households by Workers/HH	1,544,115	1,927,392	24.8	1,927,392	24.8
0 workers	356,591	552,072	54.8	552,072	54.8
1 worker	531,174	690,187	29.9	690,187	29.9
2 workers	490,800	520,730	6.1	520,730	6.1
3+ workers	165,550	164,403	-0.7	164,403	-0.7
Avg Work/HH	1.374	1.240	-9.7	1.240	-9.7
Total Workers	2,121,591	2,390,152	12.7	2,390,152	12.7
Households by Vehicles/HH	1,544,114	1,927,117	24.8	1,927,117	24.8
0 vehicles	230,060	369,077	60.4	369,127	60.4
1 vehicle	551,597	732,054	32.7	732,281	32.8
2 vehicles	550,212	579,988	5.4	579,767	5.4
3+ vehicles	212,245	245,998	15.9	245,943	15.9
Avg Veh/HH	1.51	1.39	-7.9	1.39	-7.9
Total Vehicles	2,331,205	2,679,223	14.9	2,678,832	14.9

Table 11-3
Travel Model Results

TRIP PRODUCTIONS		1995	2025 No-build	% Growth 1995-NB	2025 Build	% Growth 1995-2025
Total		16,314,955	20,557,236	26.0	20,557,147	26.0
	Ring 0	1,174,648	1,751,600	49.1	1,751,600	49.1
	Ring 1	2,770,778	3,330,875	20.2	3,330,880	20.2
	Ring 2	2,761,641	3,173,458	14.9	3,173,458	14.9
	Ring 3	4,535,449	5,401,027	19.1	5,400,933	19.1
	Ring 4	4,165,297	5,420,114	30.1	5,420,114	30.1
	Rings 0-4	15,407,813	19,077,074	23.8	19,076,985	23.8
	Externals	907,142	1,480,162	63.2	1,480,162	63.2
Home-based Work		3,271,617	4,090,245	25.0	4,090,233	25.0
	Rings 0-4	2,846,813	3,232,884	13.6	3,232,872	13.6
	Externals	424,804	857,361	101.8	857,361	101.8
HB Personal Bus		4,183,441	5,066,714	21.1	5,066,631	21.1
	Rings 0-4	3,973,146	4,799,825	20.8	4,799,742	20.8
	Externals	210,295	266,889	26.9	266,889	26.9
HB Social-Rec		2,978,211	3,501,862	17.6	3,501,862	17.6
	Rings 0-4	2,864,972	3,355,765	17.1	3,355,765	17.1
	Externals	113,239	146,097	29.0	146,097	29.0
HB School		981,490	1,082,032	10.2	1,082,032	10.2
	Rings 0-4	962,151	1,057,515	9.9	1,057,515	9.9
	Externals	19,339	24,517	26.8	24,517	26.8
HB Pckp/Drpff		637,031	705,695	10.8	705,701	10.8
	Rings 0-4	593,428	649,612	9.5	649,618	9.5
	Externals	43,603	56,083	28.6	56,083	28.6
Non-HB Work		2,259,436	3,204,825	41.8	3,204,825	41.8
	Rings 0-4	2,188,805	3,110,244	42.1	3,110,244	42.1
	Externals	70,631	94,581	33.9	94,581	33.9
Non-HB Other		2,003,719	2,905,863	45.0	2,905,863	45.0
	Rings 0-4	1,978,488	2,871,229	45.1	2,871,229	45.1
	Externals	25,231	34,634	37.3	34,634	37.3

Table 11-3 (cont.)
Travel Model Results

TRIP ATTRACTIONS	1995	No-build	% Growth 1995-NB	2025 Build	% Growth 1995-2025
Total	16,314,522	20,556,929	26.0	20,556,847	26.0
Ring 0	1,844,376	2,599,851	41.0	2,599,845	41.0
Ring 1	2,620,423	3,142,784	19.9	3,142,776	19.9
Ring 2	2,686,013	3,123,384	16.3	3,123,364	16.3
Ring 3	4,717,977	5,776,572	22.4	5,776,539	22.4
Ring 4	3,794,579	5,003,011	31.8	5,002,996	31.8
Rings 0-4	15,663,368	19,645,602	2.4	19,645,520	25.4
Externals	651,154	911,327	40.0	911,327	40.0
Home-based Work	3,271,640	4,090,255	25	4,090,246	25
Rings 0-4	3,113,454	3,866,906	24.2	3,866,897	24.2
Externals	158,186	223,349	41.2	223,349	41.2
HB Personal Bus	4,183,488	5,066,759	21.1	5,066,685	21.1
Rings 0-4	3,973,159	4,768,045	20.0	4,767,971	20.0
Externals	210,329	298,714	42.0	298,714	42.0
HB Social-Rec	2,978,247	3,501,888	17.6	3,501,888	17.6
Rings 0-4	2,848,691	3,318,194	16.5	3,318,194	16.5
Externals	129,556	183,694	41.8	183,694	41.8
HB School	981,511	1,082,073	10.2	1,082,073	10.2
Rings 0-4	954,170	1,048,777	9.9	1,048,777	9.9
Externals	27,341	33,296	21.8	33,296	21.8
HB Pckp/Drpff	636,461	705,250	10.8	705,251	10.8
Rings 0-4	606,954	662,671	9.2	662,672	9.2
Externals	29,507	42,579	44.3	42,579	44.3
Non-HB Work	2,259,451	3,204,819	41.8	3,204,819	41.8
Rings 0-4	2,188,354	3,109,669	42.1	3,109,669	42.1
Externals	71,097	95,150	33.8	95,150	33.8
Non-HB Other	2,003,724	2905,885	45.0	2,905,885	45.0
Rings 0-4	1,978,586	2,871,340	45.1	2,871,340	45.1
Externals	25,138	34,545	37.4	34,545	37.4

TABLE 11-4
Mode Split Model Results: 1995, 2025 No-Build and 2025 Build

INTRAREGIONAL PERSON TRIPS								
DAILY TOTAL		1995			2025 No-Build			2025 Build
	Mode Split	Mode Share	Mode Split	Mode Share	% Change 95-2025NB	Mode Split	Mode Share	% Change 95-2025NB
Transit	776,100	5.47%	1,225,300	6.98%	57.88%	1,263,400	7.20%	62.79%
Auto	11,171,600	78.79%	13,122,600	74.80%	17.46%	13,113,600	74.75%	17.38%
Nonmotorized (Walk/Bicycle)	2,232,100	15.74%	3,195,000	18.21%	43.14%	3,165,900	18.05%	41.84%
Subtotal - All Modes	14,179,800		17,542,900		23.72%	17,542,900		23.72%

Table 11-5
Travel Model Results

BASED ON NEW MODEL/ NEW SOCIOECONOMIC FORECASTS					
Socioeconomic and Transportation Measures	1995 Base Year	2025 No-Build	Growth 1995-2025NB	2025 Build	Growth 1995-2025B
Population	4,160,100	4,834,000	16%	4,834,000	16%
Households	1,544,100	1,927,400	25%	1,927,400	25%
Employment	2,133,900	2,799,700	31%	2,799,700	31%
Person Trips(Weekday)					
Total intraregional trips	14,179,800	17,542,900	24%	17,542,900	24%
Total linked transit trips	776,100	1,225,300	58%	1,263,400	63%
Total walk trips	2,232,100	3,195,000	43%	3,165,900	42%
Intraregional auto trips	11,171,600	13,122,600	17%	13,113,600	17%
Intraregional transit mode share	5.47%	6.98%	28%	7.20%	32%
Transit boardings (Weekday)					
Total commuter rail	93,400	231,700	148%	238,000	155%
Total rapid transit lines	676,500	1,134,000	68%	1,032,500	53%
Total local buses	365,600	572,600	57%	719,000	97%
Total express buses	35,000	50,400	44%	53,600	53%
Total transit boardings	1,170,500	1,988,700	70%	2,043,100	75%
Transfer rate	151%	162%	8%	162%	7%
Highway Statistics (Weekday)					
Total assigned vehicle trips	10,463,800	12,936,700	24%	12,942,100	24%
Total vehicle miles traveled	106,166,600	140,170,300	32%	140,510,900	32%
Total vehicle hours traveled	3,253,800	4,691,300	44%	4,639,700	43%
Average vehicle speed (MPH)	32.6	29.9	-8%	30.3	-7%
Average vehicle trip length (miles)	10.1	10.8	7%	10.9	7%

TABLE 11-6
Commuter Rail and Rapid Transit Boardings: 1995, 2025NB and 2025B

DAILY BOARDINGS					
Line Haul System	Total 1995	Year 2025 No-Build	% Change 95-25NB No-Build	Year 2025 Build	% Change 95-25B Build
COMMUTER RAIL (CRR)					
Northside Total	36,600	97,300	166%	91,700	151%
Southside Total	56,800	134,400	137%	146,300	158%
CRR Total	93,400	231,700	148%	238,000	155%
RAPID TRANSIT (RT)					
Blue Line Total	59,000	79,600	35%	90,300	53%
Orange Line Total	167,200	271,400	62%	235,200	41%
Mattapan Line Total	8,450	13,900	64%	11,900	41%
Red Line Total	220,500	449,700	104%	371,300	68%
Green Line Total	221,350	319,400	44%	323,800	46%
RT Total	676,500	1,134,000	68%	1,032,500	53%

CHAPTER 12

FINANCIAL PLAN

Federal regulations require the Regional Transportation Plan to include a financial plan comparing the estimated transportation revenue from existing and available sources, both public and private, with the estimated cost of constructing, maintaining, and operating the existing and planned transportation system. If this comparison reveals a revenue shortfall, the financial plan must identify proposed sources for the additional revenue necessary to cover the shortfall and provide strategies for ensuring the availability of such revenue.

This financial plan is limited to the components of the regional transportation system over which the Boston Region MPO has some funding or programming jurisdiction. These components are the Central Artery Project (the Project), the statewide road and bridge system, and the regional public transportation system.

THE CENTRAL ARTERY PROJECT

In October 2001, the Massachusetts Turnpike Authority submitted the latest Central Artery Finance Plan to the Federal Highway Administration (FHWA). The Finance Plan has not yet been approved, pending final discussions between the Turnpike Authority and the Federal Highway Administration relating to how to properly charge costs and revenues of the insurance program. Nevertheless, the MPO has reviewed the Finance Plan and accepts the projections contained in the plan. Therefore the cost and revenue projections for the Central Artery Project (Project) in this Regional Transportation Plan are based on the Central Artery Finance Plan, but have been adjusted where necessary to reflect events that have occurred since the submission of the Finance Plan.

Chief among these events is a reduction in the amount of federal aid estimated to be available for the Project in FY 2003 through 2011. This reduction will not impact the ultimate federal/state funding mix or the construction schedule for the Project. It could, however, affect the funding mix for particular years

and limit the ability of the Project to trade excess federal obligation authority in a given year for a like amount of non-federal aid.

The total cost of the Central Artery Project is estimated to be approximately $14.475 billion. At the end of state fiscal year 2001 (June 30, 2001), funds obligated for use on the Project totaled approximately $11.448 billion, leaving $3.027 billion to be obligated. However, approximately $1.461 billion of the previously obligated amount came from the issuance of Grant Anticipation Notes (GANs)[1]. GANs are short-term debts that are backed by a pledge of federal revenue; the state funds yearly interest payments from annual appropriations, while principal payments will be drawn from future federal highway apportionments. Since the repayment of GANs is a funding requirement of the Regional Transportation Plan, the future to-go obligations of the Central Artery Project for the purposes of this financial plan total approximately $4.488 billion. These to-go obligations will be funded from a combination of federal aid, state funds, and third-party funds.


Central Artery Construction

Two distinct funding caps limit the federal aid available for the Central Artery Project. The first cap, which was developed in 1995/96 by the state, FHWA, and the state's MPOs, provides that the Project is to receive 71% of the state's federal aid apportionment through FY 2002 and 50% thereafter until final payout. The second cap, which was imposed by FHWA on May 8, 2000, limits overall federal obligations for the Project to $8.549 billion ($7.049 billion in contract obligations and $1.5 billion for the repayment of GANs).

[1]The ultimate cost of GANs is $1.5 billion.

To date, of the $8.549 billion in federal aid available to the Project, approximately $6.140 billion has been obligated, leaving approximately $2.409 billion in remaining obligations. These remaining obligations will be funded over the next 11 years. Table 12-1 shows the region has the financial capacity to meet its Artery-related federal aid obligations over that time period. The available federal aid highway funds will be used to fund project contracts ($909 million) and the repayment of GANs ($1.5 billion).

Like all federally funded highway projects, the Central Artery Project requires matching funds from state sources. To date, the state has obligated approximately $1.407 billion of project costs through the issuance of bonds and notes. The Central Artery Finance Plan envisions the state obligating a further $170 million through the issuance of General Obligation Bonds.

In addition to these General Obligation Bonds, the state has recently taken steps to provide a large infusion of other funds for the Project. In May 2000, the state passed enabling legislation creating the Central Artery and Statewide Road and Bridge Transportation Infrastructure Trust Fund (the Infrastructure Trust Fund). The Infrastructure Trust Fund legislation authorized $1 billion in borrowing based, in part, on proceeds from annual driver license fees and biennial vehicle registration fees. Another source of money for the Fund was a required contribution of $200 million from the Massachusetts Turnpike Authority (MassPike) and $65 million from the Massachusetts Port Authority (Massport). The final source of funding was savings achieved through the early payment of bonds (defeasance) of Commonwealth debt. In 2000 three separate defeasance transactions produced savings of $659.2 million,

Table 12-1
Federal-Aid Highway Funds Available for the Central Artery Project

	FY 2002	FY 2003	FY 2004	FY 2005	FY 2006
State Apportionment	$519,000,000	$520,000,000	$520,000,000	$520,000,000	$520,000,000
Revenue Aligned Budget Authority	$63,000,000	N/A	$16,000,000	$16,000,000	$16,000,000
Total Federal Aid	$582,000,000	$520,000,000	$536,000,000	$536,000,000	$536,000,000
Artery Share	71%	50%	50%	50%	50%
Artery Apportionment	$413,000,000	$260,000,000	$268,000,000	$268,000,000	$268,000,000
Obligation Authority	88%	75%	88%	88%	88%
Available Funds	$364,000,000	$195,000,000	$236,000,000	$236,000,000	$236,000,000
less Funds Transferred to SWRB	$36,000,000	N/A	N/A	N/A	N/A
Funds Dedicated to the Project	$328,000,000	$195,000,000	$236,000,000	$236,000,000	$236,000,000

	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011
State Apportionment	$520,000,000	$520,000,000	$520,000,000	$520,000,000	$520,000,000
Revenue Aligned Budget Authority	$16,000,000	$16,000,000	$16,000,000	$16,000,000	$16,000,000
Total Federal Aid	$536,000,000	$536,000,000	$536,000,000	$536,000,000	$536,000,000
Artery Cap	50%	50%	50%	50%	50%
Artery Apportionment	$268,000,000	$268,000,000	$268,000,000	$268,000,000	$268,000,000
Obligation Authority	88%	88%	88%	88%	88%
Available Funds	$236,000,000	$236,000,000	$236,000,000	$236,000,000	$236,000,000
less Funds Transferred to SWRB	N/A	N/A	N/A	N/A	N/A
Funds Dedicated to the Project	$236,000,000	$236,000,000	$236,000,000	$236,000,000	$236,000,000

which was credited to the fund. At the time of its creation, the Infrastructure Trust Fund was estimated to have sufficient financial capacity to fund $2.168 billion in Artery costs, while also providing $500 million from the Infrastructure Trust Fund for use on the Statewide Road and Bridge Program ($100 million per year through 2005). Greater than anticipated license and registration fee revenues have raised the total contribution available from the Fund for the Project to $2.343 billion. Of this amount, $785 million has already been obligated, leaving $1.558 billion.

In addition to federal aid and state funds, the Central Artery Project has received a large amount of third-party contributions. These contributions have been provided by Massport and MassPike. Combined, the two authorities have obligated approximately $1.655 billion to the Project and will obligate an additional $351 million between 2002 and 2005.[2]

As part of the creation of the Metropolitan Highway System (MHS) in 1997, a feasibility study was conducted to determine an appropriate contribution level for the purchase of certain segments of the Project by Massport. The feasibility study concluded that Massport should pay $300 million for these assets. Massport scheduled these payments in installments between 1998 and 2005, so as to prevent any disruption to its own capital program. To date, Massport has obligated approximately $288 million of this debt, leaving $12 million remaining.

MassPike has obligated approximately $1.367 billion to the Central Artery Project since 1996 and plans to obligate another $339 million. As part of its ongoing obligations, MassPike dedicated to the Project the proceeds of the sale of 48 acres to Harvard University in July 2000 (the so-called "Allston Landing Parcels"). These proceeds, in the amount of $151.8 million, were deposited in an MHS interest-bearing reserve account. It is expected that the interest generated by this account will provide an additional $33 million for use on the Project. MassPike has also pledged to contribute at least $68 million in additional revenue from the sale or lease of property as identified in the Finance Plan. Finally, MassPike will also be contributing an additional $86.2 million in cash and bond proceeds, including $53 million for projects that were categorized as a non-Artery cost under previous finance plans.

As mentioned earlier, the remaining to-go obligation costs for the Central Artery Project are approximately $4.488 billion, including $1.5 billion for the repayment of principal on Grant Anticipation Notes. Table 12-2 provides a breakdown of the revenues that will be used to fund these obligations.

TABLE 12-2
Revenue to Fund the Remaining Central Artery Project Obligations

Federal Aid Highway Funds	**$2,409,000,000**
State General Obligation Bonds	**$170,000,000**
Infrastructure Trust Fund	**$1,558,000,000**
Massport Funds	**$12,000,000**
MassPike Funds	**$339,000,000**
Total Funds	**$4,488,000,000**

As shown, the state has sufficient financial resources to complete the construction of the Central Artery Project. Once completed in 2005, the Project will be operated and maintained by the Massachusetts Turnpike Authority. In 1996 the state commissioned a feasibility study of the Metropolitan Highway System (MHS). As recommended in the feasibility study, the MHS consists of the Boston Extension of the Massachusetts Turnpike (Boston to Route 128), the three harbor tunnels (Callahan, Sumner, and Williams), the Central Artery, and the extension of the Turnpike from South Bay to the Williams Tunnel.

The MHS Feasibility Study found that under the system as it existed in 1996 there would be an operating deficit for the MHS. In response to this

[2]These contributions are exclusive of the funds contributed to the Infrastructure Trust Fund by the authorities: $200 million by MassPike and $65 million by Massport.

concern, the MHS enabling legislation provides for an annual $25 million contribution from MassHighway toward the maintenance of the Central Artery. In addition, MassPike doubled the tolls on the harbor tunnels in 1997 and will increase tolls on the MHS in the future as needed to fund any projected operating shortfalls.

THE STATEWIDE ROAD AND BRIDGE SYSTEM

For the purpose of the development of the 2000-2025 Regional Transportation Plan, MassHighway provided each MPO with a forecast of highway revenues through 2025. This forecast projects revenues on a nominal (actual) dollar basis for the period of the Statewide Road and Bridge MOU and then makes long-range projections from 2006 through 2025 on a real (constant) dollar basis. However, costs with clearly identified payout schedules, such as commitments to the Route 3 North Project, are projected in nominal dollars throughout the plan. This forecast is the basis for the highway revenue projections contained in the Plan Update, but has been adjusted where necessary to reflect events that have occurred since the development of the 2000-2025 RTP.


Beverly Salem Bridge

Highway revenues are made up of federal aid highway funds and state funds made available on an annual basis to MassHighway. Federal aid highway funds have been projected by MassHighway based upon current apportionment levels, while state funds are based upon recent trends in non-Artery funding. In order to determine the overall level of highway funding available for the statewide road and bridge program, it is necessary to deduct certain funding programs off-the-top. These off-the-top programs include the Central Artery, other regions' mega-projects, the Route 3 North Project and statewide items (planning, extra work orders, and infrastructure maintenance). Table 12-3 shows projections of available highway revenue in six-year increments.

In recent years, the amount of funds available for the Statewide Road and Bridge Program was, to a large degree, a function of the funding needs of the Central Artery Project. In recognition of this fact and in order to meet the minimum funding needs of other roadway projects throughout the state, in September 2000, the state and its MPOs executed a Memorandum of Understanding of the Task Force of State and Regional Officials to Define, Develop and Monitor a Statewide Road and Bridge Program (Statewide Road and Bridge MOU). The Statewide Road and Bridge MOU commits MassHighway to expend no less than $400 million per year on non-Artery transportation projects in the remaining years of Artery construction (through FY 2005).

For programming and planning purposes, the Massachusetts Association of Regional Planning Agencies (MARPA) has developed targets for use in apportioning highway funding among the MPOs. Under the MARPA targets, the Boston Region MPO assumes that it will receive approximately 43% of all available highway funds. Based on that assumption and the projections contained in Table 12-3, the Boston Region MPO can expect to receive an average annual apportionment of approximately $116 million during the remaining years of Artery funding (2002-2011) and an average of approximately $273 million per year thereafter.

Table 12-3
Projections of Available Highway Funds

	2002-2007	2008-2013	2014-2019	2020-2025	Total
State Apportionment	$3,119,000,000	$3,130,000,000	$3,150,000,000	$3,150,000,000	$12,549,000,000
Revenue Aligned Budget Authority	$52,000,000	$96,000,000	$96,000,000	$96,000,000	$340,000,000
Total Federal Aid	$3,171,000,000	$3,226,000,000	$3,246,000,000	$3,246,000,000	$12,889,000,000
less Artery Share of Federal Aid	$1,707,720,000	$1,072,000,000	$0	$0	$2,779,720,000
Statewide Road and Bridge Program	$1,463,280,000	$2,154,000,000	$3,246,000,000	$3,246,000,000	$10,109,280,000
less "Off-the-Top" Funds	$873,900,000	$873,900,000	$873,900,000	$873,900,000	$3,495,600,000
Regional Programming Targets	$589,380,000	$1,280,100,000	$2,372,100,000	$2,372,100,000	$6,613,680,000
State Match for Federal Aid	$147,345,000	$320,025,000	$593,025,000	$593,025,000	$1,653,420,000
Subtotal of Federal Aid Program	$736,725,000	$1,600,125,000	$2,965,125,000	$2,965,125,000	$8,267,100,000
Non-Federal Aid Program	$792,000,000	$840,000,000	$840,000,000	$840,000,000	$3,312,000,000
Total Regional Programming Targets	$1,528,725,000	$2,440,125,000	$3,805,125,000	$3,805,125,000	$11,579,100,000
Boston MPO Share	42.97%	42.97%	42.97%	42.97%	42.97%
Boston MPO Programming Targets	$656,893,133	$1,048,521,713	$1,635,062,213	$1,635,062,213	$4,975,539,270

Between FY 1996 and FY 2000, the MPO dedicated approximately 90.8% of highway revenues to system maintenance and improvement, while obligating approximately 9.2% to system expansion. System maintenance and improvement includes infrastructure projects, such as bridge rehabilitation or highway reconstruction, and system enhancements, such as the construction of pedestrian or bicycle facilities or the signalization of intersections. System expansion includes the addition of capacity to the existing roadway network, as well as the construction of new roadways. It should be pointed out that the large percentage of funds that was obligated for system maintenance and improvement during fiscal years 1996–2000 was, in part, a function of the fact that except for the Central Artery Project no large multiyear capital projects were considered for funding in the MPO region. However, the effect of the Artery on the region's non-Artery program is beginning to lessen. In the current Transportation Improvement Program, the MPO has committed approximately 38% of its highway funding to expansion projects, while programming 62% for system maintenance and improvement.

Based upon historic trends, the MPO has determined that the appropriate level of funding for capital maintenance and improvement over the life of the Transportation Plan should be established at approximately 70% of available funding. This level of spending will require $3.483 billion for system maintenance and improvements over the 24-year period of this Regional Transportation Plan. The remaining 30%, or approximately $1.493 billion, will be used for necessary highway capacity improvements. Table 12-4 shows the level of funding available for the Maintenance and Improvement program and the Capacity program in six-year increments.[3]

[3]The actual allocation of funds among these uses will be determined during the TIP development process and may, in any given cycle, deviate from the overall 70/30 split.

The Regional Public Transportation System

In May 2000, the MBTA prepared the Forward Funding Finance Plan for submittal to the Federal Transit Administration and Wall Street bond rating agencies. The MPO has reviewed the finance plan and accepts the projections contained in the plan. Therefore, the MPO has decided to base the long-range transit projections of the Transportation Plan on the Forward Funding Finance Plan.

In prior years, the MBTA, although nominally an independent authority, operated as a quasi-state agency for budgetary purposes. MBTA capital bonds were backed by the state and operating costs were primarily funded by annual appropriations. The forward funding legislation, which became effective July 1, 2000, dramatically altered this relationship. As part of the legislation, one cent of the state sales tax was dedicated to the MBTA and the MBTA was made solely responsible for funding its operating costs and its capital program. Henceforth, all bonds issued by the authority are no longer pledges of the state, but are instead backed by MBTA revenue. The Forward Funding Finance Plan was developed to demonstrate the MBTA's financial capacity to maintain and operate its system, while undertaking a capital bonding program.

The Forward Funding Finance Plan projects operations and maintenance costs on a nominal (actual) dollar basis through 2008. It then makes long-range projections (2009 through 2030) on a real (constant) dollar basis. The exceptions are costs with clearly identified payout schedules, such as prior obligation debt service or lease pay-

Table 12-4
Projections of the Use of Available Highway Funds (Non-Artery)

	2002-2007	2008-2013	2014-2019	2020-2025	Total
Boston MPO Programming Targets	$656,893,133	$1,048,521,713	$1,635,062,213	$1,635,062,213	$4,975,539,270
Maintenance and Improvement Projects (70%)	$459,825,193	$733,965,199	$1,144,543,549	$1,144,543,549	$3,482,877,489
Highway Capacity Projects (30%)	$197,067,940	$314,556,514	$490,518,664	$490,518,664	$1,492,661,781

ments, that are projected in nominal dollars throughout the plan. This distinction is based primarily upon the fact that short-range (10 years or less) projections are usually more firm than long-range ones. It is also somewhat reflective of the fact that implicit in the MBTA's assuming fiscal responsibility for its own management is the need for costs and revenues to remain in equilibrium over the long-term, even if the only options are to raise fares or reduce service. MBTA operations and maintenance costs are made up of prior obligation debt service (principal and interest payments on bonds outstanding on July 1, 2000), prior obligation lease payments, and standard operating expenses.

Suffolk Downs

As mentioned earlier, prior to the enactment of the forward funding legislation, MBTA bonds were backed by the state. Upon the effective date of the legislation, however, contract payments from the state ceased and all outstanding debt became the responsibility of the MBTA. The projected debt service payments of these debts over the period of this Transportation Plan equal approximately $5.861 billion.

Like debt service costs, obligations under prior lease agreements became the sole responsibility of the MBTA upon the effective date of the forward funding legislation. These lease payments are not related to capital equipment or rolling stock, but are primarily the result of lease-to-own arrangements for administrative or operating equipment. These lease payments, which end in 2013, total approximately $155 million.

Standard operating expenses include: administrative costs; wages and fringe benefits; products purchased for routine, non-capital maintenance; fuel and oil; and the costs of similar goods and services necessary to keep the regional public transportation system running. Over the life of this Transportation Plan, projected operating expenses are approximately $20.120 billion. These estimates include operating expenses of the current system plus the Silver Line, Phases 1 and 2, and full Worcester Service.

An additional requirement of the Forward Funding legislation was the mandate that the MBTA maintain a cash surplus of approximately $5 million per year. Over the life of the Plan Update, this requirement equals approximately $115 million. Table 12-5 shows the projected operations and maintenance costs of the current MBTA system over the period of the Regional Transportation Plan.

As with the costs shown in Table 12-5, the Forward Funding Finance Plan projects operation and maintenance revenues on a nominal (actual) dollar basis through 2008 and then makes long-range projections from 2009 through 2030 on a real (constant) dollar basis. The revenues avail-

TABLE 12-5
Projected MBTA Operations and Maintenance Costs of the Existing System

	2002-2007	2008-2013	2014-2019	2020-2025	Total
Prior Debt Service	$1,851,000,000	$1,693,000,000	$1,315,000,000	$1,002,000,000	$5,861,000,000
Operating Lease Payments	$85,000,000	$70,000,000	$0	$0	$155,000,000
Standard Operation and Maintenance Costs	$4,748,000,000	$5,124,000,000	$5,124,000,000	$5,124,000,000	$20,120,000,000
Legislatively Required Operating Surplus	$25,000,000	$30,000,000	$30,000,000	$30,000,000	$115,000,000
Total Operating Costs	$6,709,000,000	$6,917,000,000	$6,469,000,000	$6,156,000,000	$26,251,000,000

able to fund the operation and maintenance costs come from the following sources: dedicated sales tax revenue, local assessments, federal aid, and operating revenue.

As mentioned earlier, the forward funding legislation dedicated the proceeds of one cent of sales tax to the MBTA. The legislation also provided that for state fiscal year 2001, such revenue could not be less than $645 million; additionally, the legislation provides for a 3 percent growth factor for this floor amount under certain circumstances. The floor for fiscal year 2002 is $664 million. For FY 2002-2008, the finance plan projects a sales tax growth of approximately 3 percent per year. The projected sales tax revenue over the period of this Transportation Plan equals approximately $18.524 billion.

In addition to the sales tax revenue, the MBTA is provided funding through local assessments in accordance with a statutory formula. Each community within the MBTA district is annually assessed a fee under this formula, which is automatically withheld by the legislature from quarterly local aid distributions. The forward funding legislation established the total amount of assessments within the district at $144.5 million for 2001, but also provided for a reduction in the assessments back down to 2000 levels ($136 million) between 2001 and 2006. The Forward Funding Finance Plan provides this reduction, then assumes a 2.5% growth (the maximum annual growth allowed under the limitations established by Proposition 2 1/2) in 2007 and 2008. These assumptions yield $3.41 billion over the life of the Regional Transportation Plan.

In addition to revenues provided by government, the MBTA produces its own revenue stream through the imposition of fares and charges, as well as through the sale of property and the investment of income. The Forward Funding Finance Plan projects system revenue in the following categories: base revenue, revenue from ridership growth, revenue from fare increases, and non-fare revenue. By definition, base revenue is a constant dollar estimate of the revenue generated by the current MBTA system. This revenue is approximately $262 million per year, or $6.288 billion from 2002 to 2025.

Revenue from ridership growth is based on increased use of the current system and does not include revenue increases from any planned projects. The finance plan estimates that ridership will grow by 2 percent per year except in years in which a fare increase is planned when there will be no growth. These estimates are somewhat more conservative than recent trends and will yield a 24-year total of approximately $643 million.

In addition to revenue from ridership growth, the Forward Funding Finance Plan projects revenue from recent and assumed fare increases. The finance plan projects revenue from the recent fare increase of 25% and also assumes a fare increase of 9.9% in 2003 and again in 2005. These fare increases provide $2.152 billion over the life of this Transportation Plan.

The final component of the system revenue is non-fare revenue, such as that derived from parking, concessions, advertisement, and the sale of surplus property. The MBTA has recently become more aggressive in its attempts to maximize this

TABLE 12-6
Projected MBTA Operating Revenue from the Existing System

	2002-2007	2008-2013	2014-2019	2020-2025	Total
Sales Tax	$4,286,000,000	$4,746,000,000	$4,746,000,000	$4,746,000,000	$18,524,000,000
Local Assessments	$836,000,000	$858,000,000	$858,000,000	$858,000,000	$3,410,000,000
Base Operating Revenue	$1,572,000,000	$1,572,000,000	$1,572,000,000	$1,572,000,000	$6,288,000,000
Ridership Growth	$85,000,000	$186,000,000	$186,000,000	$186,000,000	$643,000,000
Fare Increases	$424,000,000	$576,000,000	$576,000,000	$576,000,000	$2,152,000,000
Non-Fare Revenue	$106,000,000	$120,000,000	$120,000,000	$120,000,000	$466,000,000
Total MBTA Revenue	$7,309,000,000	$8,058,000,000	$8,058,000,000	$8,058,000,000	$31,483,000,000

revenue, as evidenced by a multi-million dollar, multi-year advertising contract awarded last year. The Forward Funding Finance Plan projects that this revenue will grow by $13 million in 2002, $15 million in 2003, $18 million in 2004, and $20 million in 2005. This growth would provide approximately $466 million between 2002 and 2025.

Table 12-6 shows the projected operating revenue of the current MBTA system over the period of the Regional Transportation Plan.

As shown earlier in Table 12-5, the projected operations and maintenance costs of the MBTA over the period of this Transportation Plan are $26.251 billion, while Table 12-6 shows operating revenues of $31.483 billion, leaving a projected surplus of $5.232 billion. These funds are projected to be available to fund the MBTA's capital program through a combination of pay-as-you-go funding (PAYGO) and as a pledge for revenue bonds to fund the capital program.

The MBTA capital program is composed of three funding programs: federal aid, bond proceeds, and pay-as-you-go capital (PAYGO). The Forward Funding Finance Plan envisions the MBTA gradually transitioning from a capital program that relies primarily on bonding to one that requires little, if any, bond proceeds. The Finance Plan projects capital costs as it does operating costs and revenue, except that costs with clearly identified payout schedules, such as debt service payments, are projected in nominal dollars throughout the plan. The Finance Plan projects a robust capital program from FY 2002 to 2008, ranging from a high of $638 million in 2002 to a low of $270 million in 2006. Thereafter, it ranges from a low of $256 million in 2013 to a high of $650 million in 2025.

Federal aid is projected based upon current trends under TEA-21 through 2008 and is level funded thereafter. During the remaining years of TEA-21, FY 2002-2003, federal aid is projected at a relatively high level due to the continued expenditure of New Starts funds on the South Boston section of the Silver Line. From 2004 to 2008 federal aid is projected to grow in a similar fashion as it did under TEA-21. After 2008, such aid is flatlined at $181 million per year. The total federal aid projected to be available during the period of this Transportation Plan is $4.456 billion.

After accounting for federal aid, the MBTA capital program is divided between bond proceeds and PAYGO capital in a ratio sufficient to fund the program at predetermined levels. In the short-term, the Forward Funding Finance Plan relies on bond proceeds for a large portion of the capital program but gradually transitions to a limited bond program. Over the first 14 years of the Transportation Plan, the Finance Plan estimates that the MBTA will issue bonds yielding approximately $1.802 billion in net bond proceeds (face value less debt service reserve and cost of issuance). Thereafter, the finance plan provides for no issuance of bonds and relies entirely on PAYGO capital and federal aid to fund the program.

The level of PAYGO funding is primarily a function of other available funding sources and MBTA policy concerning the efficacy of maintaining, increasing, or limiting its bonded indebtedness. During 2002-2008, while bond issuances are rather large, PAYGO capital remains somewhat limited, due to the fact that most excess revenue is used to pay debt service on new bond issuances. Thereafter, PAYGO capital will grow to a level of $79 million per year, sufficient to replace the issuance of additional bonded indebtedness. The MBTA estimates that $1.156 billion of its capital program over the period covered by the Transportation Plan will be in the form of PAYGO funding.

Table 12-7 provides a breakdown of the MBTA capital program by source.

Based upon historic trends, the Boston Region MPO assumes in the Regional Transportation Plan that over time the capital maintenance needs of the MBTA service will consume at least 70% of all available capital revenues, leaving a maximum of 30% for capital expansion projects. MBTA capital maintenance needs include infra-

Table 12-7
Projected Funds Available for the MBTA Capital Program

	2002-2007	2008-2013	2014-2019	2020-2025	Total
Federal Aid [Note 1]	$1,194,000,000	$1,090,000,000	$1,086,000,000	$1,086,000,000	$4,456,000,000
Revenue Bonds	$1,341,000,000	$419,000,000	$42,000,000	$0	$1,802,000,000
PAYGO Funds	$63,000,000	$187,000,000	$432,000,000	$474,000,000	$1,156,000,000
Carryover Funds/CIP Adjustment [Note 2]	$445,000,000	$0	$0	$0	$445,000,000
Total Capital Funds	$3,043,000,000	$1,696,000,000	$1,560,000,000	$1,560,000,000	$7,859,000,000

Note 1: This table does not include any assumed discretionary federal funding. The recommended project list included in Chapter 10 assumes the following discretionary federal aid will be received: $570 million in § 5309 New Start funding for Phase 3 of the Silver Line; $225 million in § 5309 New Start funding for the Medford Hillside Green Line Extension; and $80 million in § 5309 Bus funding for Phase 1 of the Urban Ring.

Note 2: This item represents federal and state carryover funding from previous years as reflected in the current Draft MBTA Capital Investment Program (CIP).

structure projects, such as signals and track upgrades, system enhancement projects, such as the installation of an automatic fare collection system, and accessibility projects, such as improvements necessary to comply with the Key Station Plan. Capital expansion projects, on the other hand, are projects that add new service to the system, such as the Silver Line. The actual allocation of funds between capital maintenance and expansion projects, while limited to the 70/30 split over the long-term, may vary somewhat in the short-term as necessary to meet the MBTA's legal commitments.

Table 12-8 shows the level of funding available for the Maintenance and Improvement program and the Capacity program in six-year increments.[4]

Table 12-9 provides a breakdown of the total amount of funding projected to be needed for the major components of the regional highway and public transportation system. Estimates of highway operating and debt service expenses were developed by MassHighway based upon current statewide trends.

Table 12-8
Projections of the Use of Transit Capital Funds

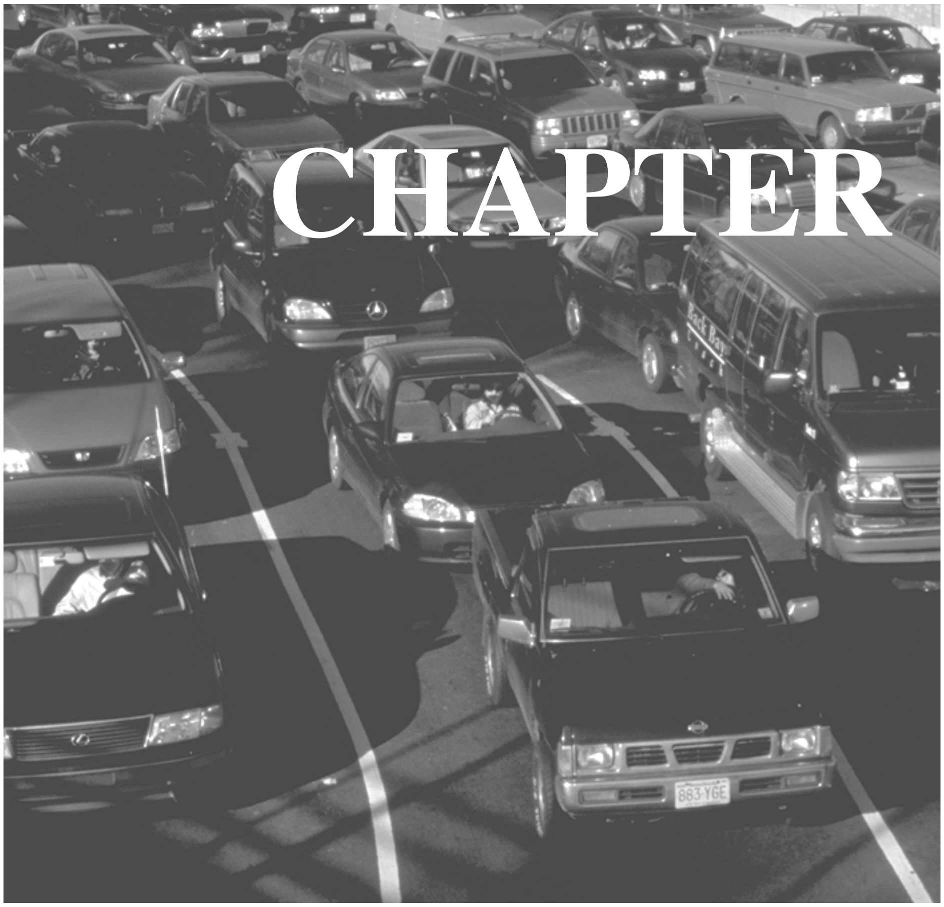
	2002-2007	2008-2013	2014-2019	2020-2025	Total
MBTA Capital Funds	$3,043,000,000	$1,696,000,000	$1,560,000,000	$1,560,000,000	$7,859,000,000
Maintenance & Improvement Projects (70%)	$2,130,100,000	$1,187,200,000	$1,092,000,000	$1,092,000,000	$5,501,300,000
Transit Capacity Projects (30%)	$912,900,000	$508,800,000	$468,000,000	$468,000,000	$2,357,700,000

Table 12-9
Projections of Regional Highway and Transit Funding, By Type

	Transit	Highways	Central Artery	Total
Operating Funds	$20,120,000,000	$1,250,000,000	N/A	$21,370,000,000
Capital Maintenance and Improvement	$5,501,300,000	$3,482,000,000	N/A	$8,983,300,000
Capital Expansion	$3,232,700,000	$1,492,000,000	$4,488,000,000	$9,212,700,000
Debt Service	$5,861,000,000	$2,500,000,000	N/A	$8,361,000,000
Total	$34,715,000,000	$8,724,000,000	$4,488,000,000	$47,927,000,000

Does not include funds expended by cities and towns, MassPike, Massport, or the Metropolitan District Commission.

[4] The actual allocation of funds between these uses will be determined during the TIP development process and may, in any given cycle, deviate from the overall 70/30 split.



CHAPTER 13

AIR QUALITY CONFORMITY DETERMINATION

INTRODUCTION

This document presents information and analyses for the latest air quality conformity determination for the Transportation Plan Update of the Boston Metropolitan Planning Organization (MPO), as required by Federal Regulations 40 CFR Part 93 and the Massachusetts Conformity Regulations (310 CMR 60.03). The information and analyses include regulatory framework, conformity requirements, planning assumptions, mobile source emissions budgets, and conformity consultation procedures.

Background

Eastern Massachusetts has historically been classified as serious nonattainment for the 1-hour ozone standard. With this nonattainment classification, the 1990 Clean Air Act Amendments (CAAA) require the Commonwealth to reduce its emissions of volatile organic compounds (VOC) and nitrogen oxides (NOx). VOC and NOx react photochemically in the presence of sunlight to form ozone. The 1-hour ozone standard established by the United States Environmental Protection Agency (EPA) is 0.12 parts per million averaged over one hour. The nonattainment classification means that this standard is not being met.

In July 1997 the EPA proposed a new 8-hour standard for ozone of 0.08 parts per million averaged over eight hours. This new standard was to become effective in September 1997 and would provide increased protection to the public. EPA also promulgated regulations providing that the revocation of the 1-hour ozone standard would occur in areas that had met the standard. This was done to facilitate continuity in public health protection during the transition to the new 8-hour standard. Monitoring data showed that Eastern Massachusetts had met the 1-hour standard from 1996 to 1998 and in June 1999, so the 1-hour standard was revoked.

However, in October 1999, due to a recent ruling of a US District Court of Appeals, EPA proposed to reinstate the 1-hour ozone standard. In the ruling, the court remanded the 8-hour ozone standard and curtailed EPA's authority to enforce it. The effectiveness of the 8-hour standard served as the underlying basis for the revocation of the 1-hour standard. The 1-hour reinstatement was finalized on July 20, 2000, and became effective in Eastern Massachusetts on January 16, 2001. The ozone conformity analysis for Eastern Massachusetts is being performed in conjunction with the development of this Regional Transportation Plan Update with the 1-hour standard.

The Boston Region MPO is also required to provide a conformity determination for carbon monoxide (CO) for the moderate CO nonattainment area of Waltham and for the nine cities and towns in the Boston CO maintenance area (Boston, Cambridge, Chelsea, Everett, Malden, Medford, Quincy, Revere, and Somerville). The two standards for CO are 9 parts per million averaged over an eight hour period and 35 parts per million averaged over one hour. With the CO nonattainment classification, the City of Waltham is required to reduce its emissions of carbon monoxide from 1990 levels.

In December 1994, the Massachusetts Department of Environmental Protection (DEP) submitted a request to redesignate the Boston CO nonattainment areas to attainment status. DEP submitted this documentation to the EPA in December 1994. In that submission, DEP established a CO emission budget for the nine cities in the Boston nonattainment area. EPA approved this State Implementation Plan (SIP) submission in the January 30, 1996 Federal Register, effective April 1, 1996. These nine communities are now designated as attainment (meeting the standards) for CO. However, they remain in maintenance status for the next twenty years. This means that the Commonwealth is required to submit conformity determinations over the next twenty years to show that CO emissions are within the standards for this area. In August 1997, a technical correction was made to the State Implementation Plan (SIP) submittal revising the projections of CO emissions in the maintenance area. The Boston Region MPO must provide a conformity determination showing that emissions of CO associated with this Plan do not exceed these projections of CO set in the SIP.

Conformity Regulations

The Clean Air Act Amendments (CAAA) revised the requirements for designated nonattainment Metropolitan Planning Organizations to perform conformity determinations by nonattainment area for their Transportation Plans and Transportation Improvement Programs (TIP). Section 176 of the CAAA defines conformity to a State Implementation Plan to mean conformity to the plan's purpose of eliminating or reducing the severity and number of violations of the National Ambient Air Quality Standards (NAAQS) and achieving expeditious attainment of the standards. The Boston Region MPO must certify that all activities outlined in the Transportation Plan Update and conformity determination:

- will not cause or contribute to any new violation of any standard in any area;
- will not increase the frequency or severity of any existing violation of any standard in any area; and
- will not delay the timely attainment of any standard or any required interim emission reductions or other milestones in any area.

The EPA issued final conformity regulations in the November 24, 1993 Federal Register and Massachusetts DEP issued new conformity regulations effective December 30, 1994. They set forth requirements for determining conformity of Transportation Plans, Transportation Improvement Programs, and individual projects. The federal conformity regulations were amended on August 15, 1997. The requirements of the conformity analysis are summarized and then explained in detail below.

Conformity Criteria

- Horizon years
- Latest planning assumptions

- Latest emission model used
- Timely implementation of transportation control measures (TCM)
- Conformity in accordance with the consultation procedures and SIP revisions
- Public Participation Procedures
- Financially Constrained Document

Procedures for Determining Regional Transportation Emissions

The Conformity Test

- Consistent with emission budgets set forth in SIP
- Contribute to reductions in CO nonattainment areas

This Plan and Conformity Determination will be showing consistency with the VOC and NOx mobile source emission budget in Eastern Massachusetts and in the nine cities and towns in the Boston CO maintenance area. The "baseline vs. action" test or "the less than 1990 emissions" test will be required in the City of Waltham CO nonattainment area because there has been no budget set for that area.

CNG Bus

Conformity Determination Criteria

This conformity determination has been prepared in accordance with 40 CFR Part 93 - Transportation Conformity Rule Amendments: Flexibility and Streamlining, Final Rule. It shows that the Transportation Plan Update for the Boston Region MPO has been prepared following all the guidelines and requirements of the rule.

Horizon Year Requirements

Horizon years for regional model analysis have been established following 40 CFR 93.106(a) of the Federal Conformity Regulations. The years for which the model was run are shown below:

- 1990 – Milestone Year – This year has been established as the base year in the SIP for calculation of emission reductions of CO.
- 1995 – Base Year – This year has been established as the base year for existing conditions for the Transportation Plan.
- 2003 – Analysis Year – VOC and NOx emissions budgets set for this year.
- 2025 – Analysis Year – last forecast year of transportation plan.

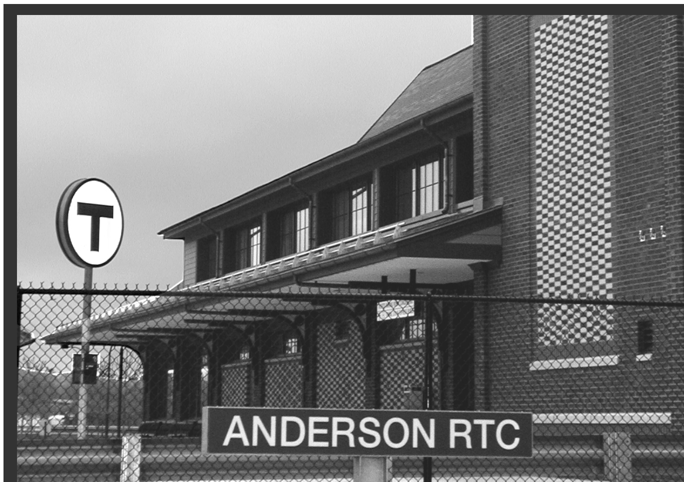
VOC and NOx emissions in the Boston Region MPO area for the years 1997, 2010 and 2020 were determined through interpolation of the modeled data. CO emissions in the Boston area and Waltham CO nonattainment area for the years 2005, 2010 and 2020 were also determined through interpolation of the modeled data.

Latest Planning Assumptions

Section 93.110 of the Federal Conformity Regulations outlines the requirements for the most recent planning assumptions that must be in place at the time of the conformity determination. Assumptions must be derived from the estimates of current and future population, employment, travel, and congestion most recently developed by the MPO. Analyses for the Boston Region MPO Transportation Plan Update and Conformity Determination are based on U.S. Census data and information obtained from MAPC and MassHigh-

way. The following is a list of the sources of data used for model calibration in the Plan Update analysis:

- Population: Summary Tape File 1B Data for Massachusetts from the 1990 U.S. Census of Population and Housing. Updated to 1995 at the city and town level with 1995 estimates prepared by the Massachusetts Institute for Social and Economic Research (MISER).
- Employment: Town-level employment from Massachusetts Department of Employment and Training, "Employment and Wages in Massachusetts' Cities and Towns 1986-1995," September 1996.



Anderson RTC

Estimates of employment below town level from factors based upon the Regional Planning Study Site-Level Employment Data Base.

- Population Forecasts: Metropolitan Area Planning Council, Population Forecasts, May 2000.
- Employment Forecasts: Metropolitan Area Planning Council, Employment Forecasts, May 2000.
- Households: Summary Tape File 1B data for Massachusetts from the 1990 U.S. Census for Population and Housing. Updated to 1995 based upon changes in population between 1990 and 1995.
- Household Forecasts: Metropolitan Area Planning Council, Household Forecasts, May 2000.
- Household Sizes: Summary Tape File 3A data for Massachusetts from the 1990 U.S. Census of Population and Housing.
- Vehicle Ownership: Summary Tape File 3A data for Massachusetts from the 1990 U.S. Census of Population and Housing was used in estimating and calibrating the CTPS Vehicle Ownership Model. Estimates after 1995 produced by application of the Vehicle Ownership Model.
- Traffic Volumes: Massachusetts Highway Department, "1995 Traffic Volumes for the Commonwealth of Massachusetts," September 1996.

Additional traffic counts taken by the Massachusetts Highway Department and the Central Transportation Planning Staff.

• Project-Level Data: Obtained from the responsible implementing agency.

Transit Operating Policy Assumptions

Transit service assumptions used in ridership modeling of the Plan Update were based on 1993/1994/1995 MBTA service. The model calibration was performed using the following:

- MBTA's Ridership and Service Statistics, March 1993.
- The Central Artery/Third Harbor Tunnel Regional Transit Mitigation Program prepared by Vanasse Hangen Brusslin for the MBTA, September 1991.

The operating policies and assumed transit ridership have not changed since the conformity determination prepared for the original 2000 Transportation Plan and its Determination of Air Quality Conformity and the 2002-2007 TIP.

Emission Inventory Assumptions

This Transportation Plan Update will be determining conformity with the Massachusetts SIP mobile source emission budgets submitted in March 1997 and October 1998 for VOC and NOx, and in December 1994, later revised in August 1997, for carbon monoxide in the nine cities and towns in the Boston CO maintenance area. The VOC mobile source emission budget for 2003 for the Massachusetts Eastern Nonattainment Area has been set at 117.118 tons per summer day and the 2003 mobile source budget for NOx is 243.328 tons per summer day.

Commuter Rail

The Boston Region MPO VOC and NOx emissions will be combined with the following MPOs/RPAs to show conformity with the SIP in the Eastern Ozone Nonattainment Area:

- Cape Cod Commission
- Central Massachusetts Regional Planning Commission
- Merrimack Valley Planning Commission
- Montachusett Regional Planning Commission
- Northern Middlesex Council of Governments
- Old Colony Planning Council
- Southeastern Regional Planning and Economic Development District
- Martha's Vineyard Commission
- Nantucket Planning and Economic Development Commission

CO emission projections have been set for the nine cities in the Boston area reclassified to attainment. An emissions attainment inventory for CO of 501.53 tons per winter day was established for all sources of CO emissions (mobile, industrial, and all other sources of CO) for the redesignation year 1993. Of that 501.53 tons, 305.43 tons per winter day were allocated for mobile sources. In addition to the attainment year inventory, EPA required that emission projections for every five years through 2010 be developed for all the sources to ensure that the combination of all CO emissions will not exceed the total 501.53 tons per winter day in the future. The mobile source emission projections have been set as shown below. Emissions from the nine cities and towns in the Boston area cannot exceed the amount in the last year of the maintenance plan (2010).

- 266.13 tons per winter day for 1995
- 226.0 tons per winter day for 2000
- 217.53 tons per winter day for 2005
- 228.33 tons per winter day for 2010

MassHighway, on behalf of the Executive Office of Transportation and Construction (EOTC) compiled the results from all the MPOs in the Eastern ozone nonattainment area. The air quality analysis has been completed for all of the MPOs and the EOTC has made the final conformity determinations for the ozone nonattainment area.

Latest Emission Model

Emission factors used for calculating emission changes were determined using MOBILE 5A-H (November 1995), the model used by DEP in determining the mobile source budget. Emission factors for motor vehicles are specific to each model year, pollutant type, temperature and travel speed. MOBILE 5A-H requires a wide range of input parameters including inspection and mainte-

nance program information, anti-tampering rates, hot/cold start mix, emission failure rates, vehicle fleet mix, fleet age distribution, etc.

The input variables used in this conformity determination were received from DEP. The inputs used for the 1990 base case existing network were the same as those used in determining the 1990 Emissions Inventory for the Commonwealth of Massachusetts. The inputs used for the years 1995 through 2025 were also received from DEP and include information on programs that were submitted to EPA in 1993, 1994, 1997, 1998, and 1999 as the control strategy for the Commonwealth to obtain ambient air quality standards for 1999.

HOV lane

The input variables used in the emission factor model runs for analysis of the Plan Update are shown in Appendix G. These inputs were determined through the consultation procedures as required by the conformity regulations. The model output provides an estimate of emissions in grams per mile for varying speeds and at varying temperatures for a variety of vehicle types. The emission factors used in the analyses are provided in Appendix G.

Timely Implementation of Transportation Control Measures

Transportation control measures (TCMs) have been required in the SIP in revisions submitted to EPA in 1979 and 1982 and those submitted as mitigation for the construction of the Central Artery project. Those TCMs included in the 1979 and 1982 submission have all been accomplished through construction or through implementation of ongoing programs. The only exceptions are the bus immersion heater program, the Newton Rider bus service, the private bus insurance discount concept, and the pedestrian malls in Lynn, Cambridge, and Needham. These TCMs have been substituted with other services. A list of the TCMs is provided in Appendix G. These projects have all been included in past Boston Region MPO Transportation Plans and TIPs.

TCMs that were submitted as a SIP commitment as part of the Central Artery mitigation are also included in Appendix G. The status of these projects has been updated using the Administrative Consent Order (ACO) signed by EOTC and the Executive Office of Environmental Affairs (EOEA) on September 1, 2000, and the quarterly summary of actions taken by EOTC, MassHighway, MBTA, and other agencies to fulfill their mitigation commitments to the Central Artery (dated July 16, 2001.) All of the projects have been included in the Region's Transportation Plan as recommended projects or projects requiring further study. A list of those projects include:

- Southeast Expressway High Occupancy Vehicle Lane
- HOV Lane on I-93 Mystic Avenue
- 20,000 New Park and Ride Spaces
- Ipswich Commuter Rail Extension to Newburyport
- Old Colony Commuter Rail Extension
- Framingham Commuter Rail Extension to Worcester
- Green Line Extension to Medford Hillside
- Red Line/Blue Line Connector
- South Boston Piers Transitway

The administrative consent order recently signed by EOTC and EOEA reconciles and adjusts dates of completion for all projects required as mitigation for the Central Artery that have not been completed to date. This conformity determination includes all projects that are part of the ACO. The two transit TCM SIP commitment projects that have not been completed include the Greenbush Line of the Old Colony Commuter Rail Service and the Arborway Restoration project. Substitute projects are required for these projects until they are completed. These substitutes have not yet been approved by DEP. Therefore, the Greenbush and Arborway projects have been included in this conformity determination since any substitutes will require at least the same air quality benefits. Thus, the emissions from these projects have been accounted for.

Consultation Procedures

The final conformity regulations require that the MPO must make a conformity determination according to consultation procedures set forth in federal and state regulations and it must also follow public involvement procedures established by the MPO under federal metropolitan transportation planning regulations.

The consultation requirements of both the state and federal regulations require that the Boston Region MPO, EOTC/MassHighway Planning, MA. DEP, EPA - Region 1, and FHWA - Region 1 consult on the following issues:

- Selection of regional emissions analysis models including model development and assessment of project design factors for modeling.
- Selection of inputs to the most recent EPA-approved emissions factor model.
- Selection of CO hotspot modeling procedures, as necessary.
- Identification of regionally significant projects to be included in the regional emissions analysis.
- Identification of projects that have changed in design and scope.
- Identification of exempt projects.
- Identification of exempt projects that should be treated as non-exempt because of adverse air quality impacts.
- Identification of the latest planning assumptions and determination of consistency with SIP assumptions.

These issues have all been addressed through consultation among or with the agencies listed above.

Public Participation Procedures

Title 23 CFR Section 450.324 and 40 CFR 90.105(e) require that the development of the Plan, TIP, and related certification documents provide an adequate opportunity for public review and comment.

Section 450.316(b) establishes the outline for MPO public participation programs. The Boston Region MPO's public participation program was formally adopted in July 1994. The development and adoption of this program conforms to the requirements of this section. It guarantees public access to the Plan and all supporting documentation, provides for public notification of the availability of the Plan and the public's right to review the document and comment thereon, and provides a 30-day public review and comment period prior to the adoption of the Plan and its Conformity Determination and related certification documents by the MPO.

On January 27, 2002, a public notice was advertised in the Boston Globe informing the public of its right to comment on the document. On March 12, 2002 the Transportation Planning and Programming Committee of the Boston Region MPO recommended that the MPO endorse the Plan Update and its Conformity. Consequently, on March 14, 2002 the Boston Region MPO voted to approve the Transportation Plan Update and its conformity determination. This allowed ample opportunity for public comment and MPO review of the draft document. These procedures comply with the associated federal requirements.

Financial Consistency

Title 23 CFR Section 450.324 and 40 CFR 93.108 require the Transportation Plan Update and Conformity Determination to "be financially constrained by year and include a financial plan that demonstrates which projects can be implemented using current revenue sources and which projects are to be implemented using proposed revenue sources."

The Transportation Plan Update and Conformity Determination is financially constrained to projections of federal and state resources reasonably expected to be available during the appropriate time-frame. Projections of federal resources are based upon the estimated apportionment of the federal authorizations contained in TEA 21, as allocated to the region by the state or as allocated among the various MPOs according to federal formulae or MPO agreement. Projections of state resources are based upon historic trends. Therefore, the Transportation Plan Update and Conformity Determination substantially complies with federal requirements relating to financial planning.

PROCEDURES FOR DETERMINING REGIONAL TRANSPORTATION EMISSIONS

The federal conformity regulations set forth specific requirements for determining transportation emissions. A summary of these requirements and the procedures used in this Transportation Plan Update and Conformity Determination as amended are summarized below.

Demographic, Employment and Transportation Demand

Specific sources of population, employment and traffic information used in the Transportation Plan have been listed above under the Latest Planning Assumptions section. Chapter 3 of the Transportation Plan Update describes the scenario that was analyzed to help determine the final recommendations of the Transportation Plan Update. Chapter 4 of the Transportation Plan Update outlines the specific project recommendations that are set forth in the Transportation Plan for the Boston Region MPO through the year 2025.

Only regionally significant projects are required to be included in the regional modeling efforts. The final federal conformity regulations define regionally significant as follows:

> Regionally significant: a transportation project (other than an exempt project) that is on a facility which serves regional transportation needs (such as access to and from the area outside of the region, major activity centers in the region, major planned developments such as new retail malls, sport complexes, etc., or transportation terminals as well as most terminals themselves) and would be included in the modeling of a metropolitan area's transportation network, including at a minimum all principal arterial highways and all fixed guideway transit facilities that offer an alternative to regional highway travel. A listing of projects exempt from any air quality analysis is included in Appendix G.

In addition, specific projects have been exempt from regional modeling emissions analysis. The categories of projects include:

- Intersection channelization projects,
- Intersection signalization projects at individual intersections,
- Interchange reconfiguration projects,
- Changes in vertical and horizontal alignment,
- Truck size and weight inspection stations, and
- Bus terminals and transfer points.

The 1997 Conformity Amendments have allowed traffic signal synchronization projects to be exempt from conformity determinations prior to their funding, approval or implementation. However, once they are implemented, they must be included in determinations for future plans and TIPs.

The Build Network is composed of projects proposed in the approved TIPs, the Transportation

Plan Update, and projects in the MBTA capital budget. A listing of the projects that meet these criteria and are included as part of the Transportation Plan Update Action networks is shown in Table 13-1.

In addition to emissions calculated from the network model, a separate analysis was performed off-model to determine emissions from commuter rail, commuter boat, and the MBTA bus program.

Changes in Project Design Since the Last Conformity Determination Analysis

The Commonwealth requires that any changes in project design from the previous conformity determination for the region be identified. The last conformity determination was performed on the 2000 Transportation Plan adopted in January 2001. Since the last conformity determination the only changes that have been made are the mix of projects included in the recommended plan.

Model Specific Information

40 CFR Part 93.111 of the federal regulations outlines requirements to be used in the network-based transportation demand models. These requirements include modeling methods and functional relationships to be used in accordance with acceptable professional practice and reasonable for purposes of emission estimation. The Boston Region MPO has used the methods described in the conformity regulations in the analysis of this Transportation Plan Update.

Highway Performance Monitoring System Adjustments

As stated in guidance by EPA, all areas of serious ozone and carbon monoxide nonattainment must use the Federal Highway Administration's Highway Performance Monitoring System (HPMS) to track vehicle miles of travel (VMT) prior to attainment to ensure that the state is on line with commitments made in reaching attainment of the ambient air quality standards by the required attainment dates. MassHighway provides the HPMS information to DEP. DEP used this information in setting mobile source budgets for VOC, NOx, and CO in all SIP revisions prior to 1997. DEP has since revised its VOC and NOx budgets using transportation demand model runs factored to HPMS data. HPMS remains the accepted tracking procedure set forth by EPA. The CO budget for the Boston area CO attainment area had been set prior to using transportation model data.

The conformity regulations require that all model-based VMT be compared with the HPMS VMT to ensure that the region is in line with VMT and emission projections made by DEP. An adjustment factor has been developed which compares the 1995 HPMS VMT to the 1995 transportation model VMT. This adjustment factor is then applied to all modeled VOC and NOx emissions for years 2003 through 2025 to ensure consistency with EPA accepted procedures.

$$\frac{\text{1995 HPMS VMT}}{\text{1995 Modeled VMT}} = \text{Adjustment Factor}$$

$$\frac{55{,}244{,}000}{74{,}560{,}260} = 0.7409 \text{ Adjustment Factor for VOC and NOx}$$

1997 was chosen as the base year for modeled emission estimates for the entire Eastern Massachusetts Non-Attainment Area (previous conformity determinations had used 1990 - now outdated - as a base year). Some regions, including the Boston Region MPO, selected a different model base year due to better data availability (consistent with the latest planning assumptions). HPMS-factored model results from these regions have been adjusted to represent 1997 estimates so that all regions could be added together to produce a benchmark level for the entire Non-Attainment area.

Since the CO emission budget for the Boston CO attainment area was determined using the HPMS method rather than the transportation model, a different adjustment factor is applied to the CO emissions for the nine cities and towns. This was done by comparing the 1990 CO emissions from the nine cities and towns resulting from the 1990 base year model run to the 1990 HPMS generated

Table 13-1
2000 Transportation Plan: Future Needs Analysis
Action Scenarios

HIGHWAY PROJECTS	2003 BUILD	2010 BUILD	2020 BUILD	2025 BUILD
Central Artery	partial	X	X	X
Third Harbor Tunnel/Haul Road	X	X	X	X
Haul Road/Mass Ave/SE Expressway	X	X	X	X
Crosby Dr. (Bedford)		X	X	X
Middlesex Turnpike (Bedford & Burlington)		X	X	X
Rte. 128 Capacity Improvements (Beverly to Peabody)			X	X
Rte. 128 Capacity Improvements (Lynnfield to Reading)		X	X	X
Rte. 128 Additional Lanes (Randolph to Wellesley)		X	X	X
East Boston Haul Rd. (Boston)		X	X	X
Rte. 1A/Boardman St. Grade Separation (Boston)		X	X	X
Rutherford Avenue (Boston)		X	X	X
Double Stack Initiative (Boston to Newton)		X	X	X
Mass. Ave./Lafayette Square (Cambridge)	X	X	X	X
Cambridgeport Roadways (Cambridge)		X	X	X
I-93/I-95 Interchange (Canton)		X	X	X
I-95 (NB)/Dedham St. Ramp (Canton)		X	X	X
I-95 (SB)/Dedham St. Onramp (Canton)	X	X	X	X
Concord Rotary (Concord)		X	X	X
Rte. 2/Crosby's Corner (Concord)		X	X	X
Rte. 1/114 Corridor Improvements (Danvers & Peabody)		X	X	X
Telecom City Roadways (Everett, Malden, & Medford)	partial	X	X	X
Revere Beach Parkway (Everett, Medford, & Revere)		X	X	X
Rte. 126/Rte. 135 Grade Separation (Framingham)		X	X	X
Rte. 9/Rte. 126 Interchange (Framingham)		X	X	X
Double Stack Initiative (Framingham to Worcester)		X	X	X
Rte. 140 (Franklin)		X	X	X
Rte. 53 (Hanover)		X	X	X
Rte. 53/Rte. 228 (Hingham & Norwell)		X	X	X
Naval Air Station Access Improvements		X	X	X
I-495/I-290/Rte. 85 Interchange Hudson & Marlborough)		X	X	X
Rte. 1 Improvements (Malden & Revere)		X	X	X
Rte. 20, Segments 1 & 2 (Marlborough)	X	X	X	X
Rte. 20, Segment 3 (Marlborough)		X	X	X
Double Stack Initiative (Natick & Wellesley)		X	X	X
Needham St./Highland Ave. (Needham & Newton)		X	X	X
Burgin Parkway (Quincy)		X	X	X
Quincy Center Concourse, Phase 1 (Quincy)	X	X	X	X
Quincy Center Concourse, Phase 2 (Quincy)		X	X	X
I-93/Rte. 129 Interchange (Reading & Wilmington)		X	X	X
I-93/I-95 Interchange (Reading & Woburn)		X	X	X
Mahoney Circle Grade Separation (Revere)		X	X	X
Rte. 1/Rte. 16 Interchange (Revere)		X	X	X
Rte. 1A/Rte. 16 Connection (Revere)		X	X	X
Boston St. (Salem)		X	X	X
Bridge St. (Salem)		X	X	X
Bridge St. Bypass (Salem)	X	X	X	X
I-93/Mystic Ave. Interchange (Somerville)		X	X	X
Rte. 18 (Weymouth)		X	X	X
Rte. 3 South Additional Lanes (Weymouth to Duxbury)	partial*	X	X	X
I-93/Ballardvale St. Interchange (Wilmington)		X	X	X

*includes the use of the breakdown lane during peak periods

TABLE 13-1
2000 Transportation Plan: Future Needs Analysis
Action Scenarios

HIGHWAY PROJECTS (cont.)	2003 BUILD	2010 BUILD	2020 BUILD	2025 BUILD
New Boston Street Bridge (Woburn)		X	X	X
Beverly-Salem Bridge	X	X	X	X
Route 62, Burlington	X	X	X	X
Route 38, Wilmington	X	X	X	X
Route 139 Widening	X	X	X	X
Blue Hill Avenue Signal Coordination	X	X	X	X
Brighton Avenue Signal Coordination	X	X	X	X
Marret Road Signal Coordination	X	X	X	X
Route 3 North General Purpose Lane		X	X	X
I-495 Interchange between Route 9 and Route 20	X	X	X	X
I-93 Industriplex Interchange	X	X	X	X
Route 138 Widening, Canton	X	X	X	X
Foxborough Route 1 Improvements	X	X	X	X
Route 9 Improvements, Wellesley	X	X	X	X
COMMUTER RAIL PROJECTS				
New Bedford/Fall River Commuter Rail		X	X	X
Old Colony Commuter Rail, Phase I	X	X	X	X
Old Colony/Greenbush Commuter Rail	X	X	X	X
Fairmount Branch Improvements (Boston)		X	X	X
Newburyport	X	X	X	X
Worcester, Full Service	X	X	X	X
INTER-CITY RAIL PROJECTS				
AMTRAK Service to Portland, Maine	X	X	X	X
Northeast Corridor Electrification	X	X	X	X
RAPID TRANSIT PROJECTS				
Arborway Restoration (Boston)	X	X	X	X
Red Line/Blue Line Connector (Boston)			X	X
Medford Hillside Green Line (Boston, Medford, & Somerville)			X	X
Silver Line, Phase 3 (Boston)			X	X
Assembly Square Orange Line Station (Somerville)		X	X	X
Blue Line Platform Lengthening & Modernization		X	X	X
Mattapan Refurbishment	X	X	X	X
South Boston Piers Transitway, Phase I	X	X	X	X
Washington Street Transitway (Silver Line)	X	X	X	X
Airport Intermodal Transit Connector	X	X	X	X
HOV AND BUS PROJECTS				
Urban Ring Bus Service	X	X	X	X
Urban Ring, Phase 1 (Inner Core)		X	X	X
100 Additional Buses (Regionwide)		X	X	X
HOV Lanes on the Southeast Expressway	X	X	X	X
HOV Lanes on I-93 Mystic Avenue	X	X	X	X
INTERMODAL PROJECTS				
10,000 New Park and Ride Spaces since 1991	X	X	X	X
10,000 Additional Park and Ride Spaces	X	X	X	X
Park and Ride (Regionwide) (over the 20,000)	partial	X	X	X
North Station Improvements	X	X	X	X
South Station Transportation Center	X	X	X	X
Industriplex Intermodal Center	X	X	X	X
Rte 128 AMTRAK/Commuter Rail Station	X	X	X	X
Commuter Boat, Inner Harbor - from North Station	X	X	X	X
Russia Wharf	X	X	X	X

CO emissions submitted as part of the SIP. The HPMS data was divided by the model data to determine the CO adjustment factor to be applied to all modeled CO emissions for future years. This calculation is as follows:

$$\frac{\text{1990 HPMS Emissions}}{\text{1990 Modeled Emissions}} = \text{Adjustment Factor}$$

$$\frac{\text{343.41 tons/day}}{\text{483.17 tons/day}} = \text{0.71 CO Adjustment Factor}$$

The Conformity Test

Consistent with emission budgets set forth in SIP

The Boston Region MPO has conducted an air quality analysis of the Transportation Plan Update. The purpose of the analysis is to evaluate the Plan's air quality impacts on the State Implementation Plan (SIP). The analysis evaluates the change in ozone precursor (VOCs and NOx) emissions and carbon monoxide emissions due to implementation of the Transportation Plan Update. The modeling procedures and assumptions used in this air quality analysis follow the EPA's final conformity regulations issued on August 15, 1997. They are also consistent with procedures used by the Massachusetts DEP to develop Massachusetts' 1990 Base Year Emission Inventory, 1996 Reasonable Further Progress Plan, the Post-1996 Reasonable Further Progress Plan, 1996 Rate of Progress Report, and the Ozone Attainment Demonstration for the SIP. All consultation procedures were followed to ensure that a complete analysis of the Transportation Plan Update and Conformity Determination was performed in consistency with the SIP.

The primary test to show conformity with the SIP is to show that the Air Quality Conformity of the Transportation Plan Update is consistent with the emission budgets set forth in the SIP. The Massachusetts Reasonable Further Progress Plan (RFP) has been deemed complete by the EPA in a letter dated June 5, 1997. EPA has made a determination that the 15% RFP SIP submittal contains an adequate mobile source emissions budget to conduct conformity determinations using the conformity criteria. In addition, the 2003 mobile source emission budget was found adequate for conformity purposes by EPA on February 19, 1999.

The VOC mobile source budget for 2003 for the Massachusetts Eastern Nonattainment Area has been set at 117.118 tons per summer day and the 2003 mobile source budget for NOx budget is 243.328 tons per summer day. The CO mobile source attainment inventory for 1993 for the nine cities in the Boston area recently reclassified as attainment is 305.43 tons per winter day. The projections provided for mobile sources for the Boston area are 266.13 tons per winter day for 1995, 226.0 tons per winter day for 2000, 217.53 tons per winter day for 2005, and 228.33 tons per winter day for 2010.

The total tons per day of VOCs and NOx for the Eastern Massachusetts nonattainment area from all of the analyzed scenarios are shown in Tables 13-2 and 13-3. The total tons per winter day of CO emissions for the nine cities in the Boston

Table 13-2
VOC Emissions Estimates for the Eastern Massachusetts Ozone Nonattainment Area
(all emissions in tons per summer day)

Year	Boston MPO* Action Emissions	Eastern MA Action Emissions	Budget	Difference (Action -Budget)
1997	119.176	219.059	n/a	n/a
2003	56.610	114.030	117.118	-3.088
2010	50.875	104.224	117.118	-12.894
2020	53.164	110.006	117.118	-7.112
2025	52.311	112.021	117.118	-5.097

TABLE 13-3
NOx Emissions Estimates for the Eastern Massachusetts Ozone Nonattainment Area
(all emissions in tons per summer day)

Year	Boston MPO* Action Emissions	Eastern MA Action Emissions	Budget	Difference (Action -Budget)
1997	179.858	341.458	n/a	n/a
2003	111.297	234.295	243.328	-9.033
2010	105.873	224.221	243.328	-19.117
2020	110.579	234.619	243.328	-8.709
2025	110.196	237.686	243.328	-5.642

**Note: Does not include commuter rail, commuter boat and MBTA bus emissions which are listed in Appendix D.*

TABLE 13-4
Winter Carbon Monoxide Emissions from the CO Maintenance Area for the Nine Cities in the Boston Area
(Tons/Winter Day)

Year	Action Emissions	SIP Emissions Projections	Difference (Action -Budget)
1993	305.43	n/a	n/a
2003	165.13	226.00	-60.87
2005	164.80	217.53	-52.73
2010	163.97	228.33	-64.36
2020	162.31	228.33	-66.02
2025	161.48	228.33	-66.85

TABLE 13-5
Winter Carbon Monoxide Emissions from the CO NonattainmentArea for the City of Waltham only
(Kilograms/Winter Day)

Year	Baseline Emissions (1990)	Action Emissions	Difference (Action -1990 Emissions)
1990	31,457	n/a	n/a
2003	n/a	16,364	-15,093
2005	n/a	16,370	-15,087
2010	n/a	16,386	-15,071
2020	n/a	16,417	-15,040
2025	n/a	16,433	-15,024

maintenance area are shown in Table 13-4. The results of the air quality analysis demonstrate that the VOC, NOx, and CO emissions from all Action scenarios are less than the Massachusetts VOC, NOx, and CO emission budgets.

Contribute to Reductions in CO Nonattainment Areas

The City of Waltham must report CO emissions within their city because they are classified as nonattainment for CO. The “baseline vs. action” test or “the less than 1990 emissions” test must be done in Waltham because there has been no mobile source emission budget established for this area. Table 13-5 reports the action CO emissions as compared to the 1990 CO emissions from Waltham. As shown in Table 13-5, the emissions from all the action scenarios are less than the 1990 baseline emissions. Therefore, the less than 1990 emissions test is met.

CONCLUSION

The Clean Air Act Amendments of 1990 established new requirements for transportation plans, programs, and projects. EPA published a final rule in the November 24, 1993, Federal Register which was last amended on August 15, 1997, providing procedures to be followed by the United States Department of Transportation in

determining conformity of transportation plans, programs, and projects with the SIP.

The Boston Region MPO has conducted an air quality analysis of the Transportation Plan Update and its latest conformity determination. The purpose of the analysis is to evaluate the plan's air quality impacts on the SIP. The analysis evaluates the change in ozone precursor emissions (VOCs, and NOx) and CO emissions due to the implementation of the Transportation Plan Update. The modeling procedures and assumptions used in this air quality analysis follow EPA's and the Commonwealth's guidance and are consistent with the procedures used by the Massachusetts DEP to develop Massachusetts' 1990 Base Year Emissions Inventory, 1996 Reasonable Further Progress Plan, the Post-1996 Reasonable Further Progress Plan, 1996 Rate of Progress Report, the Ozone Attainment Demonstration for the SIP, and the emissions inventory for the Boston area CO maintenance area included in the SIP.

Eastern Massachusetts has historically been designated as a Serious ozone nonattainment area. The City of Waltham is designated as nonattainment for CO. Nine cities and towns in the Boston area have recently been redesignated from nonattainment to attainment for CO. The EPA conformity regulations require that transportation plans, programs, and projects evaluate their impact on nonattainment areas. Eastern Massachusetts is made up of ten regional planning agencies (RPAs). Therefore, VOC and NOx emissions must be combined in order to compare the results to the conformity criteria.

EPA has found the base year emissions inventories, the 15% Plan, the 9% Plan, and the contingency submittal administratively and technically complete in a letter dated June 5, 1997. In addition, the 2003 mobile source emission budget was found adequate for conformity purposes by EPA on February 19, 1999. This establishes the new mobile source emission budgets for which the new conformity determinations will be based. In addition, EPA has made a conditional interim approval of the Massachusetts 15% Rate of Progress Report and Contingency Plan in a letter dated June 18, 1997.

Accordingly, the EOTC has found the emission levels from the Boston Region MPO Transportation Plan Update and Conformity Determination in combination with the emission levels from the other RPAs in Eastern Massachusetts to be in conformance with the SIP according to conformity criteria. Specifically, the following conditions are met:

- The VOC emissions for the Action (build) scenarios are less than the 2003 VOC mobile source emission budgets for analysis years 2003 through 2025.
- The NOx emissions for the Action (build) scenario are less than the 2003 NOx mobile source emission budgets for analysis years 2003 through 2025.
- The CO emissions for the Action (build) scenarios are less than the 1993 CO mobile source emission budget and projections for analysis years 2005 through 2025 for the nine cities in the Boston area CO maintenance area.
- CO emissions for Waltham for the Action (Build) scenario for all analysis years are less than Waltham's base year 1990 emissions.

In accordance with Section 176(c)(4) of the Clean Air Act as amended in 1990, the MPO for the Boston Region has completed its review and hereby certifies that the Boston Region MPO Transportation Plan Update and its latest conformity determination conditionally conforms with 40 CFR Parts 93 and 310 CMR 60.03.

APPENDIX A

ENVIRONMENTAL JUSTICE AND THE REGIONAL TRANSPORTATION PLAN

This appendix provides information on all of the transit performance measures used by the MPO in its environmental justice analysis. The transit performance methods were discussed at Environmental Justice Ad Hoc meetings over the past year. (A list of the meetings is also provided.) The MPO's transit performance measures relate to scheduled frequency, vehicle loading, vehicle assignment, schedule adherence, bus shelter location, and transit mobility.

The following pages include detailed information on scheduled frequency and adherence, vehicle loading, vehicle assignment for each bus route, rapid transit line and commuter rail line, and shelter availability. The first page of tables provides definitions for the indicators that are included in this appendix. Following are two tables for each indicator – the first provides a summary and the second provides the details for each indicator. The summary tables for each indicator are presented first (Tables 1-5), followed by the detailed tables (Tables 1A-5A). A map showing the recommended projects in the Plan in relation to low income and minority population is also included in this Appendix.

Table 1 and 1A – Scheduled Frequency:
Scheduled frequency (also referred to as headways) is provided for the AM peak, midday, the PM peak, the evening and all day Saturday and Sunday.

Table 2 and 2A – Vehicle Loading:
Vehicle load factors and crowd factors are provided for the peak thirty-minute period on a typical weekday, Saturday and Sunday.

Table 3 and 3A – Vehicle Assignment:
The average age of the vehicles and the percent that have air conditioning are provided.

Table 4 and 4A – Schedule Adherence:
On-time performance is provided for a typical weekday, a typical Saturday and a typical Sunday.

Table 5 and 5A – Shelter Availability
Provides information on shelter locations.

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ENVIRONMENTAL JUSTICE AD HOC COMMITTEE MEETINGS IN 2001

February 13, 2001	• Discussion of the federal certification review • Discussion of a working definition of "environmental justice" • Distribution of transit data: weekend peak load & daily ridership
March 13, 2001	• Discussion of EJ transit measures • Discussion of EJ highway measures • Discussion of public outreach methods • Distribution of transit data on schedule adherence
April 19, 2001	• Discussion of EJ transit measures • Discussion of EJ highway measures
May 3, 2001	• Discussion of EJ transit performance measures • Discussion of transit mobility measures • Discussion of EJ highway measures
May 17, 2001	• Discussion of EJ transit performance measures • Discussion of transit mobility measures • Discussion of EJ highway measures
May 29, 2001	• Review of planned transit projects • Discussion of EJ performance measures
July 26, 2001	• Discussion of the TIP and UPWP process
August 9, 2001	• Discussion of the Circulation Draft UPWP and TIP
August 30, 2001	• Discussion of a possible UPWP project on EJ issues • Discussion of TIP projects • Discussion of 2025 Build Scenarios for the RTP
October 18, 2001	• Discussion of RTP policies • Discussion of RTP Universe of Projects • Discussion of 2025 Build Scenarios
October 25, 2001	• Development of a list of projects for recommendation to the MPO by the EJ Ad Hoc Committee for inclusion in an RTP 2025 Build Scenario
October 31, 2001	• Finalization of a list of projects for recommendation to the MPO by the EJ Ad Hoc Committee for inclusion in an RTP 2025 Build Scenario

MEMORANDUM

TO: **Sub-Signatory Committee**

DATE: **October 31, 2001**

FROM: **Anne McGahan, Manager, Transportation Plan**
David Mohler, Manager, Environmental Justice Initiative

RE: **Recommendations of the Environmental Justice Ad Hoc Committee**

The last three meetings of the Environmental Justice Ad Hoc Committee have focused on the projects and policies for the update of the Transportation Plan. The following are the Committee's consensus recommendations on those issues.

Recommended Projects

The Committee supports many of the transit projects already included in the two alternative 2025 Build Scenarios tested to date, particularly service improvements on the Fairmont Branch, the reinstitution of Arborway Green Line service, and the extension of Green Line service to Medford Hillside. In addition to these projects, the Committee strongly recommends that the next Build Scenario and, indeed, the final Transportation Plan include two additional projects: the institution of light rail service on Washington Street from Dudley Square to Park Street[1] and the purchase of 100 additional alternative fuel (non-diesel) buses.

The Committee's best estimate of the current cost of these two additional projects is approximately $200 million: $165 million for the light rail project and $35 million for the bus purchase. In order to fund these projects within the plan's financial constraint requirements, the Committee recommends that the MPO eliminate unnecessary costs currently included in other projects and consider shifting some costs for project components from transit funding to highway funding including, if necessary, deleting projects from the previous Build Scenarios.

[1] As envisioned by the Committee, this service should, if feasible, ultimately be extended from Dudley Square to Mattpan. While this extension may not yet be ready for inclusion in the current Transportation Plan, the Committee intends to pursue this issue in future discussions with the MPO.

Specifically, the Committee recommends that the MPO eliminate approximately $152 million in unnecessary costs currently included in other projects:

- $113 million of the cost of the Silver Line Connection, which is the cost of modifying the Tremont Street Tunnel for BRT service that would no longer be necessary if light rail is instituted on Washington Street;

- $27 million of the cost of the Red/Blue Connector, which is the cost of reconstructing Charles Street Station and will be funded by the MBTA under its Accessibility Program; and

- $12 million of the cost of Urban Ring, Phase 2, which is the cost of providing an exclusive bus/truck right-of-way in East Boston and is funded under the highway program as the East Boston Haul Road.

In addition to these cost savings, the Committee suggests that the MPO consider funding the final $48 million worth of costs needed for its recommendations by funding the highway-related costs of the Urban Ring with highway funds; funding commuter rail parking expansion with highway funds; reducing the overall level of additional commuter rail parking; or eliminating one or more highway projects.

Policies

The Environmental Justice Ad Hoc Committee has one consensus recommendation regarding the MPO's draft policies: delete Policy 12 C, which calls for the MPO to promote new public-private partnerships as a way to provide needed services. The Committee is concerned that this policy could be used as an excuse to allow private development concerns to drive transportation decisions. Additionally, the effect of the policy may be to place EJ communities at a disadvantage since it is often difficult to interest large-scale private developers to invest in the such communities.

Other Issues

The issues outlined above are the most urgent matters needing to be addressed given the MPO's current schedule for plan development. The Committee looks forward to working with the MPO on other issues during plan development, such as the need to discuss a vision that goes beyond current estimates of financial constraint, the definition of major non-capacity projects of concern to the EJ communities, and the possible reconsideration of one or more legal commitments imposed upon the MPO.

Definitions

Vehicle Loading

Load Factor:	Number of passengers on board/seats
Crowd Factor:	Number of passengers on board/capacity

Capacity (as % of seats)

Bus/Trackless Trolley:	140%	(40 seats)
Commuter Rail:	100%	(110-180 seats)
Green Line:	220%	(46 seats)
Red Line:	270%	(50-62 seats)
Orange Line:	225%	(58 seats)
Blue Line:	225%	(42 seats)

Headway

Very frequent:	Every 1-15 minutes
Frequent:	Every 16-30 minutes
Less frequent:	Every 31-60 minutes
Infrequent:	Less than every 60 minutes/limited service

Schedule Adherence

On Time (Bus/Trackless Trolley):

<u>Every 10 minutes or less frequent</u>

Departs origin 0-5 minutes late (inclusive) AND

Arrives destination between 2 minutes early and 5 minutes late (inclusive)

<u>More frequent than every 10 minutes</u>

Observed interval between buses is less than or equal to

1.5 times the scheduled interval

Table A-1
Preliminary Summary - Scheduled Frequency

AM Peak	Minority	Non Minority	Low Income	Non Low Income
Bus/Trackless Trolley - Very Frequent	46.67%	28.72%	47.73%	32.80%
Bus/Trackless Trolley - Frequent	45.33%	54.26%	47.73%	51.20%
Bus/Trackless Trolley - Less Frequent	4.00%	10.64%	2.27%	9.60%
Bus/Trackless Trolley - Infrequent	2.67%	5.32%	2.27%	4.80%
Bus/Trackless Trolley - Not Operating	1.33%	1.06%	0.00%	1.60%
Midday	**Minority**	**Non Minority**	**Low Income**	**Non Low Income**
Bus/Trackless Trolley - Very Frequent	20.00%	5.32%	25.00%	7.20%
Bus/Trackless Trolley - Frequent	48.00%	24.47%	40.91%	32.80%
Bus/Trackless Trolley - Less Frequent	25.33%	43.62%	25.00%	39.20%
Bus/Trackless Trolley - Infrequent	0.00%	5.32%	0.00%	4.00%
Bus/Trackless Trolley - Not Operating	6.67%	21.28%	9.09%	16.80%
PM Peak	**Minority**	**Non Minority**	**Low Income**	**Non Low Income**
Bus/Trackless Trolley - Very Frequent	41.33%	28.72%	40.91%	32.00%
Bus/Trackless Trolley - Frequent	46.67%	47.87%	45.45%	48.00%
Bus/Trackless Trolley - Less Frequent	6.67%	14.89%	9.09%	12.00%
Bus/Trackless Trolley - Infrequent	2.67%	4.26%	2.27%	4.00%
Bus/Trackless Trolley - Not Operating	2.67%	4.26%	2.27%	4.00%
Evening	**Minority**	**Non Minority**	**Low Income**	**Non Low Income**
Bus/Trackless Trolley - Very Frequent	6.67%	1.06%	9.09%	1.60%
Bus/Trackless Trolley - Frequent	29.33%	7.45%	29.55%	12.80%
Bus/Trackless Trolley - Less Frequent	32.00%	31.91%	29.55%	32.80%
Bus/Trackless Trolley - Infrequent	0.00%	5.32%	0.00%	4.00%
Bus/Trackless Trolley - Not Operating	32.00%	54.26%	31.82%	48.80%
Saturday	**Minority**	**Non Minority**	**Low Income**	**Non Low Income**
Bus/Trackless Trolley - Very Frequent	17.33%	3.19%	20.45%	5.60%
Bus/Trackless Trolley - Frequent	41.33%	26.60%	43.18%	29.60%
Bus/Trackless Trolley - Less Frequent	24.00%	35.11%	18.18%	34.40%
Bus/Trackless Trolley - Infrequent	0.00%	5.32%	0.00%	4.00%
Bus/Trackless Trolley - Not Operating	17.33%	29.79%	18.18%	26.40%
Sunday	**Minority**	**Non Minority**	**Low Income**	**Non Low Income**
Bus/Trackless Trolley - Very Frequent	12.00%	1.06%	13.64%	3.20%
Bus/Trackless Trolley - Frequent	16.00%	4.26%	15.91%	7.20%
Bus/Trackless Trolley - Less Frequent	40.00%	32.98%	38.64%	35.20%
Bus/Trackless Trolley - Infrequent	0.00%	5.32%	0.00%	4.00%
Bus/Trackless Trolley - Not Operating	32.00%	56.38%	31.82%	50.40%

Number of Minority Bus/Trackless Trolley Routes = 75
Number of Non Minority Bus/Trackless Trolley Routes = 94

Number of Low Income Bus/Trackless Trolley Routes = 44
Number of Non Low Income Bus/Trackless Trolley Routes = 125

Table A-2
Preliminary Summary - Vehicle Loading
(Typical Weekday - Peak 30 Minutes)

Category	Avg. Crowd Factor/ Avg. Load Factor	% of Routes with Crowd Factor > 71% Load Factor > 100%	Crowd Factor > 75% Load Factor > 105%	Crowd Factor > 90% Load Factor > 126%	Crowd Factor > 100% Load Factor > 140%
Bus/Trackless Trolley - Minority	77.45% / 108.43%	58.67%	56.00%	26.67%	13.33%
Bus/Trackless Trolley - Non Minority	70.79% / 99.10%	45.74%	42.55%	18.09%	6.38%
Bus/Trackless Trolley - Low Income	79.58% / 111.41%	59.09%	56.82%	25.00%	15.91%
Bus/Trackless Trolley - Non Low Income	71.38% / 99.94%	48.80%	45.60%	20.80%	7.20%
Bus/Trackless Trolley - Overall	*74.04%* / *103.65%*	*51.48%*	*48.52%*	*21.89%*	*9.47%*
Commuter Rail - Rockport	97.10% / 97.10%				
Commuter Rail - Newburyport	73.60% / 73.60%				
Commuter Rail - Haverhill	80.94% / 80.94%				
Commuter Rail - Lowell	95.47% / 95.47%				
Commuter Rail - Fitchburg	88.76% / 88.76%				
Commuter Rail - Worcester	81.97% / 81.97%				
Commuter Rail - Needham	86.08% / 86.08%				
Commuter Rail - Franklin	95.72% / 95.72%				
Commuter Rail - Providence	113.53% / 113.53%				
Commuter Rail - Fairmount	29.43% / 29.43%				
Commuter Rail - Middleborough	109.04% / 109.04%				
Commuter Rail - Plymouth/Kingston	124.25% / 124.25%				
Green Line - Boston College (B)	76.58% / 168.48%				
Green Line - Cleveland Circle (C)	92.98% / 204.57%				
Green Line - Riverside (D)	95.11% / 209.24%				
Green Line - Heath Street (E)	60.40% / 132.88%				
Green Line - Central Subway	81.10% / 178.42%				
Red Line - Mattapan High Speed Line	70.07% / 154.15%				
Red Line - Ashmont Branch	56.85% / 153.50%				
Red Line - Braintree Branch	87.75% / 236.93%				
Red Line - Cambridge	65.28% / 176.25%				
Orange Line	81.55% / 183.50%				
Blue Line	90.83% / 204.37%				

Table A-2
Preliminary Summary - Vehicle Loading

(Typical Saturday - Peak 30 Minutes)

Category	Avg. Crowd Factor/ Avg. Load Factor			% of Routes with Crowd Factor > 71% Load Factor > 100%	Crowd Factor > 75% Load Factor > 105%	Crowd Factor > 90% Load Factor > 126%	Crowd Factor > 100% Load Factor > 140%
Bus/Trackless Trolley - Minority	64.49%	/	90.29%	33.87%	24.19%	12.90%	11.29%
Bus/Trackless Trolley - Non Minority	52.83%	/	73.97%	22.73%	15.15%	7.58%	4.55%
Bus/Trackless Trolley - Low Income	67.77%	/	94.88%	33.33%	27.78%	16.67%	16.67%
Bus/Trackless Trolley - Non Low Income	54.42%	/	76.19%	26.09%	16.30%	7.61%	4.35%
Bus/Trackless Trolley - Overall	*59.32%*	/	*83.05%*	*28.13%*	*19.53%*	*10.16%*	*7.81%*

(Typical Sunday - Peak 30 Minutes)

Category	Avg. Crowd Factor/ Avg. Load Factor			% of Routes with Crowd Factor > 71% Load Factor > 100%	Crowd Factor > 75% Load Factor > 105%	Crowd Factor > 90% Load Factor > 126%	Crowd Factor > 100% Load Factor > 140%
Bus/Trackless Trolley - Minority	66.13%	/	92.58%	30.61%	28.57%	18.37%	16.33%
Bus/Trackless Trolley - Non Minority	59.58%	/	83.41%	30.00%	25.00%	7.50%	0.00%
Bus/Trackless Trolley - Low Income	68.57%	/	96.00%	30.00%	30.00%	23.33%	20.00%
Bus/Trackless Trolley - Non Low Income	60.32%	/	84.44%	30.51%	25.42%	8.47%	3.39%
Bus/Trackless Trolley - Overall	*63.52%*	/	*88.93%*	*30.34%*	*26.97%*	*13.48%*	*8.99%*

Table A-3
Preliminary Summary - Vehicle Assignment

	Average Age	% Air Conditioned
Bus/Trackless Trolley - Minority	10.09	80.15%
Bus/Trackless Trolley - Non Minority	12.95	62.79%
Bus/Trackless Trolley - Low Income	9.67	82.24%
Bus/Trackless Trolley - Non Low Income	12.28	67.12%
Bus/Trackless Trolley - Overall	*11.32*	*72.69%*
Commuter Rail - Newburyport/Rockport	13.80	100.00%
Commuter Rail - Haverhill	13.78	100.00%
Commuter Rail - Lowell	13.68	100.00%
Commuter Rail - Fitchburg	13.61	100.00%
Commuter Rail - Worcester	11.57	100.00%
Commuter Rail - Needham	12.24	100.00%
Commuter Rail - Franklin	11.81	100.00%
Commuter Rail - Providence	11.50	100.00%
Commuter Rail - Stoughton	11.70	100.00%
Commuter Rail - Fairmount	12.16	100.00%
Commuter Rail - Middleborough	7.75	100.00%
Commuter Rail - Plymouth/Kingston	7.19	100.00%
Commuter Rail - Overall	*11.75*	*100.00%*
Green Line - Boston College (B)	No Info Avail.	100.00%
Green Line - Cleveland Circle (C)	No Info Avail.	100.00%
Green Line - Riverside (D)	No Info Avail.	100.00%
Green Line - Heath Street (E)	No Info Avail.	100.00%
Green Line - Overall	No Info Avail.	*100.00%*
Red Line - Mattapan High Speed Line	57.00	0.00%
Red Line - Ashmont Branch	14.50	100.00%
Red Line - Braintree Branch	17.80	100.00%
Red Line (Ashmont/Braintree) - Overall	*16.20*	*100.00%*
Orange Line	21.00	100.00%
Blue Line	23.00	100.00%

Table A-4
Preliminary Summary - Schedule Adherence

(Typical Weekday)

Category	**% Trips On Time**
Bus/Trackless Trolley - Minority	61.99%
Bus/Trackless Trolley - Non Minority	61.60%
Bus/Trackless Trolley - Low Income	60.84%
Bus/Trackless Trolley - Non Low Income	62.41%
Bus/Trackless Trolley - Overall	*61.82%*

(Typical Saturday)

Category	**% Trips On Time**
Bus/Trackless Trolley - Minority	62.72%
Bus/Trackless Trolley - Non Minority	54.23%
Bus/Trackless Trolley - Low Income	63.86%
Bus/Trackless Trolley - Non Low Income	56.24%
Bus/Trackless Trolley - Overall	*59.33%*

(Typical Sunday)

Category	**% Trips On Time**
Bus/Trackless Trolley - Minority	64.49%
Bus/Trackless Trolley - Non Minority	63.15%
Bus/Trackless Trolley - Low Income	63.35%
Bus/Trackless Trolley - Non Low Income	64.47%
Bus/Trackless Trolley - Overall	*64.04%*

Table A-5
Preliminary Summary - Shelter Locations

Category	% of Shelters	% of Bus Routes
Minority	43.98%	44.38%
Non Minority	56.02%	55.62%
Low Income	26.39%	26.04%
Non Low Income	73.61%	73.96%

Table A-1A (Expanded)
Scheduled Frequency in Minutes

L = Limited Service X = No Service

Mode	Route	Route Name	Minority	Low Income	AM Peak	Midday	PM Peak	Evening	Saturday	Sunday
Bus/TT	1	Harvard/Holyoke Gate to Dudley Sta	Yes	No	8.5	12	7.5	16	11	15
Bus/TT	3	City Pt. to Chinatown via Boston Marine Ind Pk	No	Yes	16	X	22	X	X	X
Bus/TT	4	N Sta to World Trade Ctr	Yes	No	17.5	X	17.5	X	X	X
Bus/TT	5	City Point to McCormack Housing	No	No	X	60	X	X	60	X
Bus/TT	6	Boston Marine Ind Park to Haymarket via S Sta	No	No	30	X	30	X	X	X
Bus/TT	7	City Point to Otis & Summer Sts	No	No	8.5	18	11	40	25	X
Bus/TT	8	Harbor Point/UMass to Kenmore Sta	Yes	Yes	12	33.5	20	45	50	50
Bus/TT	9	City Point to Copley Sq	No	No	8.5	13.5	11	30	20	30
Bus/TT	10	City Point to Copley Sq via Andrew Sta	Yes	Yes	15	27.5	16	60	22	40
Bus/TT	11	City Point (via Bayview) to Downtown	No	Yes	6	15	11	30	20	30
Bus/TT	14	Roslindale Sq to Dudley Sta	Yes	Yes	30	60	30	X	60	X
Bus/TT	15	Kane Sq or Fields Corner Sta to Ruggles Sta	Yes	Yes	5	12.5	9	30	16	45
Bus/TT	16	Forest Hills Sta to Andrew Sta or UMass	Yes	Yes	16	30	15	40	30	50
Bus/TT	17	Fields Corner Sta to Andrew Sta	Yes	Yes	14	17.5	14	40	20	40
Bus/TT	18	Ashmont Sta to Andrew Sta	Yes	Yes	30	60	30	X	60	60
Bus/TT	19	Fields Corner Sta to Ruggles Sta	Yes	Yes	15	60	25	X	X	X
Bus/TT	20	Fields Corner to Fields Corner via Neponset and Adams	Yes	No	12	15	30	30	30	30
Bus/TT	21	Ashmont Sta to Forest Hills Sta	Yes	No	9	20	11	40	45	X
Bus/TT	22	Ashmont Sta to Ruggles Sta	Yes	Yes	6	13	7	20	11	15
Bus/TT	23	Ashmont Sta to Ruggles Sta via Washington St	Yes	Yes	4	11	7	20	11	16
Bus/TT	24	Wakefield Ave.& Truman Pkwy to Mattapan or Ashmont Sta	Yes	No	20	40	25	60	50	50
Bus/TT	26	Ashmont Sta to Norfolk & Morton Belt Line	Yes	No	15	22.5	15	30	30	60
Bus/TT	27	Mattapan Sta to Ashmont Sta	Yes	No	30	30	30	30	30	60
Bus/TT	28	Mattapan Sta to Ruggles Sta	Yes	Yes	6	9	8	20	9	12
Bus/TT	29	Mattapan Sta to Jackson Sq, Sta	Yes	Yes	16	60	15	30	20	X
Bus/TT	30	Mattapan Sta to Roslindale Sq	Yes	No	25	27.5	25	60	50	60

Table A-1A (Expanded)
Scheduled Frequency in Minutes

L = Limited Service **X = No Service**

Mode	Route	Route Name	Minority	Low Income	AM Peak	Midday	PM Peak	Evening	Saturday	Sunday
Bus/TT	31	Mattapan Sta to Forest Hills Sta	Yes	No	6	11	8	20	13	20
Bus/TT	32	Wolcott Sq to Forest Hills Sta	Yes	Yes	10	12	10	30	12	15
Bus/TT	33	Dedham Line to Mattapan Sta	Yes	No	30	60	30	X	60	X
Bus/TT	34	Dedham Line to Forest Hills Sta	No	No	9	22.5	7.5	60	30	30
Bus/TT	34E	Walpole Ctr to Forest Hills Sta via Washington St	No	No	20	30	20	60	30	60
Bus/TT	35	Dedham Mall/Stimson St. to Forest Hills Sta	No	No	20	22.5	15	X	30	60
Bus/TT	36	Charles River Loop or V.A. Hosp to Forest Hills Sta	No	No	16	30	15	30	30	30
Bus/TT	37	Baker & Vt Sts to Forest Hills Sta	No	No	20	30	15	X	30	60
Bus/TT	38	Wren St to Forest Hills Sta	Yes	No	22	40	22	X	40	X
Bus/TT	39	Forest Hills Sta to Back Bay Sta	Yes	Yes	3.5	8.5	5	10	7	8
Bus/TT	40	Georgetowne to Forest Hills Sta	No	No	30	40	30	X	60	X
Bus/TT	41	Centre & Eliot Sts to Dudley Sta	Yes	Yes	16	27	16	30	40	X
Bus/TT	42	Forest Hills Sta to Ruggles Sta	Yes	Yes	20	20	20	50	18	50
Bus/TT	43	Ruggles Sta to Park & Tremont Sts	Yes	Yes	10	13.5	10	20	15	20
Bus/TT	44	Jackson Sq Sta to Ruggles Sta	Yes	Yes	11	16.5	11	30	16	45
Bus/TT	45	Franklin Park Zoo to Ruggles Sta	Yes	Yes	7.5	16.5	8.5	30	16	45
Bus/TT	46	Heath St & S Huntington Ave to Dudley Sta	Yes	Yes	30	30	30	X	30	X
Bus/TT	47	Central Sq, Cambridge to Broadway Sta	Yes	Yes	20	20	18	45	22	40
Bus/TT	48	Centre & Eliot Sts to Jamaica Plain Loop	Yes	No	X	32.5	X	X	35	X
Bus/TT	49	Dudley Sta to Downtown	Yes	Yes	7	8	6	15	9	11
Bus/TT	50	Cleary Sq to Forest Hills Sta	Yes	No	20	40	20	X	60	X
Bus/TT	51	Reservoir (Cleveland Cir) to Forest Hills Sta	No	No	20	40	20	60	60	X
Bus/TT	52	Dedham Mall or Charles River Loop to Watertown Sq	No	No	30	45	30	X	90	X
Bus/TT	55	Jersey & Queensbury Sts to Copley Sq or Park	Yes	Yes	16.5	60	60	30	30	30
Bus/TT	57	Watertown Sq to Kenmore Sta	Yes	Yes	6.5	8.5	6.5	10	7.5	15
Bus/TT	59	Needham Junction to Watertown Sq	No	No	38	35	30	X	45	X

Table A-1A (Expanded)
Scheduled Frequency in Minutes

L = Limited Service **X = No Service**

Mode	Route	Route Name	Minority	Low Income	AM Peak	Midday	PM Peak	Evening	Saturday	Sunday
Bus/TT	60	Chesnut Hill to Kenmore Sta	Yes	No	17	29	24	45	31.5	60
Bus/TT	62	Bedford V.A. Hospital to Alewife Sta	No	No	30	52.5	30	X	60	X
Bus/TT	64	Oak Sq to University Pk or Kendall/MIT via Central Sq	Yes	No	20	30	20	60	60	60
Bus/TT	65	Brighton Ctr to Kenmore Sta	Yes	Yes	20	29	24	X	31.5	X
Bus/TT	66	Harvard Sq to Dudley Sta	Yes	No	9	12.5	9.5	25	15	30
Bus/TT	67	Turkey Hill to Alewife Sta	No	No	25	45	25	X	X	X
Bus/TT	68	Harvard Sq to Kendall/MIT via Broadway	Yes	No	30	30	30	X	X	X
Bus/TT	69	Harvard/Holyoke Gate to Lechmere Sta	Yes	No	14	16.5	17	30	20	30
Bus/TT	70	Cedarwood or Watertown Sq to University Pk	Yes	No	15	30	10	30	20	15
Bus/TT	70A	N Waltham to University Pk via Arsenal St & Western Ave	No	No	35	60	30	X	40	X
Bus/TT	71	Watertown Square to Harvard Station	No	No	7	11	9.5	30	12	50
Bus/TT	72	Huron Ave to Harvard Sta	Yes	No	15	22.5	15	30	30	40
Bus/TT	73	Waverly Sq to Harvard Sta	No	No	5	12	4.5	30	12	50
Bus/TT	74	Belmont Ctr to Harvard Sta	Yes	No	17	25	19	40	30	40
Bus/TT	75	Belmont Ctr to Harvard Sta	Yes	No	L	60	L	X	X	X
Bus/TT	76	Hanscom AFB to Alewife Sta via Mass Ave	No	No	30	60	30	60	X	60
Bus/TT	77	Arlington Heights to Harvard Sta	No	No	8	9.5	6.5	12	8	15
Bus/TT	77A	N Cambridge to Harvard Sta	Yes	No	10	11	9	12	8	15
Bus/TT	78	Arlmont Village to Harvard Sta	No	No	17	25	19	60	60	60
Bus/TT	79	Arlington Heights to Alewife Sta	No	No	12	21	11	45	X	X
Bus/TT	80	Arlington Ctr to Lechmere Sta	Yes	No	15	27.5	15	60	30	60
Bus/TT	83	Rindge Ave to Central Sq, Cambridge	Yes	Yes	8	22.5	15	60	25	40
Bus/TT	84	Arlmont Village to Alewife Sta	No	No	30	X	17	X	X	X
Bus/TT	85	Spring Hill to Kendall/MIT Sta	Yes	Yes	30	40	40	X	X	X
Bus/TT	86	Sullivan Sq Sta to Reservoir (Cleveland Cir)	Yes	No	10	25	20	60	35	30
Bus/TT	87	Arlington Ctr or Clarendon Hill to Lechmere Sta	Yes	No	17	24	15	30	24	30

Table A-1A (Expanded)
Scheduled Frequency in Minutes

L = Limited Service **X = No Service**

Mode	Route	Route Name	Minority	Low Income	AM Peak	Midday	PM Peak	Evening	Saturday	Sunday
Bus/TT	88	Clarendon Hill to Lechmere Sta	Yes	Yes	6	22.5	15	30	24	30
Bus/TT	89	Clarendon Hill to Sullivan Sq	Yes	No	9	22.5	9.5	60	30	60
Bus/TT	90	Davis Sq to Wellington Sta	Yes	Yes	30	52.5	35	60	60	X
Bus/TT	91	Sullivan Sq Sta to Central Sq,Cambridge	Yes	Yes	25	25	25	60	20	40
Bus/TT	92	Assembly Sq Mall to Downtown via Main St.	No	No	10	30	13	20	30	X
Bus/TT	93	Sullivan Sq Sta to Downtown via Bunker Hill St	No	No	5	20	7	30	20	40
Bus/TT	94	Medford Sq to Davis Sq Sta	No	No	17	40	20	40	22	40
Bus/TT	95	W Medford to Sullivan Sq Sta	No	No	15	30	15	60	30	60
Bus/TT	96	Medford Squ to Harvard Sta	No	No	20	40	20	60	30	60
Bus/TT	97	Malden Ctr Sta to Wellington Sta	No	No	30	60	30	X	50	X
Bus/TT	99	Boston Regional Med Ctr to Wellington Sta	No	No	25	32.5	25	60	30	60
Bus/TT	100	Elm St to Wellington Sta	No	No	20	35	20	60	30	60
Bus/TT	101	Malden Center Sta - Sullivan Sq Sta	No	No	12	22.5	12	60	30	60
Bus/TT	104	Malden Ctr Sta to Sullivan Sq Sta	Yes	No	12	25	15	60	30	60
Bus/TT	105	Malden Ctr Sta to Sullivan Sq Sta	Yes	No	30	60	30	X	60	60
Bus/TT	106	Lebanon St, Malden to Wellington Sta	Yes	No	20	25	20	60	30	60
Bus/TT	108	Linden Sq to Wellington Sta	No	No	25	30	30	60	30	60
Bus/TT	109	Linden Sq to Sullivan Sq Sta	No	No	12	25	15	60	30	60
Bus/TT	110	Wonderland or Park Ave. & Broadway to Wellington Sta	No	No	20	30	20	60	30	60
Bus/TT	111	Woodlawn to Haymarket Sta	Yes	Yes	6	13.5	6	15	12	16
Bus/TT	112	Wellington Sta to Wood Island Sta	Yes	Yes	30	37.5	30	X	35	50
Bus/TT	114	Bellingham Sq to Maverick St	Yes	Yes	10	40	X	X	X	X
Bus/TT	116	Wonderland Sta to Maverick Sta	Yes	Yes	18	25	20	60	30	60
Bus/TT	117	Wonderland Sta to Maverick Sta	Yes	Yes	18	25	20	60	30	60
Bus/TT	119	Northgate to Beachmont Sta	No	No	30	60	30	60	60	40
Bus/TT	120	Orient Heights to Maverick Sta	Yes	Yes	16	20	20	60	30	50

Table A-1A (Expanded)
Scheduled Frequency in Minutes

L = Limited Service **X = No Service**

Mode	Route	Route Name	Minority	Low Income	AM Peak	Midday	PM Peak	Evening	Saturday	Sunday
Bus/TT	121	Wood Island Sta to Maverick Sta	Yes	Yes	30	X	25	X	X	X
Bus/TT	130	Lebanon St, Melrose to Malden Ctr Sta	No	No	30	90	45	X	90	X
Bus/TT	131	Melrose Highlands to Malden Ctr Sta	No	No	30	60	30	X	X	X
Bus/TT	132	Redstone Shopping Ctr to Malden Ctr Sta	No	No	30	90	45	X	90	X
Bus/TT	134	N Woburn to Wellington Sta	No	No	60	60	60	X	60	X
Bus/TT	136	Reading Depot to Malden Sta	No	No	30	70	45	X	60	X
Bus/TT	137	Reading Depot to Malden Sta	No	No	30	70	30	80	60	X
Bus/TT	170	Dudley Sta to Oak Park	Yes	Yes	L	X	L	X	X	X
Bus/TT	210	Quincy Ctr Sta to N Quincy or Fields Corner	No	No	30	45	30	X	30	X
Bus/TT	211	Quincy Ctr Sta to Squantum via Montclair	No	No	30	60	30	X	60	X
Bus/TT	212	Quincy Ctr Sta to N Quincy Sta	No	No	30	X	60	60	60	X
Bus/TT	214	Quincy Ctr Sta to Germantown	No	No	11	30	20	60	20	40
Bus/TT	215	Quincy Ctr Sta to Ashmont Sta	No	No	20	25	30	60	35	60
Bus/TT	216	Quincy Ctr Sta to Houghs Neck	No	No	9	25	20	60	20	40
Bus/TT	217	Wollaston Beach to Ashmont Sta via Beale St	No	No	30	X	60	X	120	X
Bus/TT	220	Quincy Ctr Sta to Hingham or Fort Point	No	No	10	35	17	60	30	60
Bus/TT	221	Quincy Ctr Sta to Hingham or Fort Point	No	No	40	X	X	X	X	X
Bus/TT	222	Quincy Ctr Sta to E Weymouth	No	No	11	30	15	60	30	60
Bus/TT	225	Quincy Ctr Sta to Weymouth Landing	No	No	10	30	10	60	30	60
Bus/TT	230	Quincy Ctr Sta to Brockton Line	No	No	24	60	30	60	60	60
Bus/TT	236	Quincy Ctr Sta to S Shore Plaza	No	No	90	60	30	X	60	60
Bus/TT	238	Quincy Ctr Sta to Holbrook/Randolph Commuter Rail Sta	No	No	30	55	30	60	60	60
Bus/TT	240	Avon Line or Holbrook/Randolph Comm Rail Sta to Ashmont	No	No	20	60	20	60	60	60
Bus/TT	245	Quincy Ctr Sta to Mattapan Sta via Pleasant St	No	No	30	60	20	X	120	X
Bus/TT	325	Medford to Haymarket	No	No	12	X	15	X	X	X
Bus/TT	326	W Medford to Haymarket Sta	No	No	12	X	15	X	X	X

Table A-1A (Expanded)
Scheduled Frequency in Minutes

L = Limited Service **X = No Service**

Mode	Route	Route Name	Minority	Low Income	AM Peak	Midday	PM Peak	Evening	Saturday	Sunday
Bus/TT	350	N Burlington to Alewife Sta	No	No	20	60	20	60	60	50
Bus/TT	351	Oak Park to Alewife Station Express	No	No	30	X	30	X	X	X
Bus/TT	352	Burlington to Boston via Rts 128 & 93	No	No	15	X	15	X	X	X
Bus/TT	354	Woburn Line to Boston via I-93	No	No	13	90	13	X	X	X
Bus/TT	355	Mishawum Sta to Boston	No	No	L	X	X	X	X	X
Bus/TT	411	Malden Center Station to Jack Satter House	No	No	35	52.5	50	X	60	X
Bus/TT	425	Central Sq, Lynn to Wonderland via Linden Sq	No	No	24	X	X	X	X	X
Bus/TT	426	Central Sq,Lynn & E Saugus to Haymarket Sta	No	No	30	60	15	85	60	60
Bus/TT	427	Granada Highlands to Haymarket via Linden Sq	No	No	L	X	L	X	X	X
Bus/TT	428	Oaklandvale to Haymarket via Cliftondale Sq	No	No	L	X	L	X	X	X
Bus/TT	429	Central Sq, Lynn to Linden Sq	No	No	30	45	30	90	60	90
Bus/TT	430	Saugus Ironworks to Malden Center Sta	No	No	40	60	25	85	60	X
Bus/TT	433	Pine Hill to Central Sq, Lynn	Yes	Yes	40	X	40	X	X	X
Bus/TT	435	Lynn to Danvers via North Shore & Liberty Tree Malls	No	No	75	60	120	90	60	120
Bus/TT	436	Goodwin Cir to Central Sq, Lynn	No	No	30	60	35	X	60	120
Bus/TT	437	Lake Shore Park to Central Sq, Lynn	No	No	30	45	30	X	X	X
Bus/TT	439	Central Sq, Lynn to Bass Point, Nahant	No	No	30	X	25	X	X	X
Bus/TT	441	Marblehead to Haymarket or Dtwn Xing via Paradise St	No	No	24	60	24	X	60	120
Bus/TT	442	Marblehead to Haymarket via Humphrey St	No	No	30	60	30	60	60	120
Bus/TT	448	Marblehead to Dntn Xing via Paradise Rd	No	No	60	X	60	X	X	X
Bus/TT	449	Marblehead to Downtown Xing via Humphrey St	No	No	60	X	60	X	X	X
Bus/TT	450	Salem Depot to Haymarket Sta	No	Yes	10	60	20	60	60	60
Bus/TT	451	N Beverly to Salem Depot	No	No	60	60	60	X	X	X
Bus/TT	455	Salem Depot to Haymarket via Loring Ave & Central Sq, Lynn	Yes	No	60	60	30	50	30	60
Bus/TT	458	Salem Depot to Danvers Sq via Liberty Tree Mall	No	No	30	60	40	X	X	X
Bus/TT	459	Salem Depot to Dntn Xing via Humphrey St,	Yes	No	60	60	60	X	X	X

Table A-1A (Expanded)
Scheduled Frequency in Minutes

L = Limited Service **X = No Service**

Mode	Route	Route Name	Minority	Low Income	AM Peak	Midday	PM Peak	Evening	Saturday	Sunday
Bus/TT	468	Salem Depot to Danvers Sq	No	No	40	X	L	X	X	X
Bus/TT	500	Riverside to Downtown Boston	No	No	12	X	15	X	X	X
Bus/TT	501	Brighton Ctr to Downtown Boston	Yes	No	4	X	5	X	X	X
Bus/TT	502	Watertown Sq to Copley Sq	No	No	7	30	10	X	35	X
Bus/TT	504	Watertown Sq to Downtown Boston	No	No	6	30	10	X	35	X
Bus/TT	505	Central Sq, Waltham to Dntn Boston	No	No	6	30	8	X	X	X
Bus/TT	553	Roberts to Dntn Boston via Newton Corner & Mass Pike	No	No	25	60	60	X	60	X
Bus/TT	554	Waverley Sq to Downtown Boston	No	No	30	60	60	X	60	X
Bus/TT	556	Waltham Hlds. to Downtown Boston via Mass Pike	No	No	30	60	30	X	X	X
Bus/TT	558	Auburndale to Downtown Boston via Newton Cnr & Mass Pike	No	No	30	X	30	X	X	X
Bus/TT	CT1	Central Sq, Cambridge to BU Medical Ctr	Yes	No	15	30	15	X	X	X
Bus/TT	CT2	Kendall/MIT Station to Ruggles Sta	Yes	Yes	20	30	20	X	X	X
Bus/TT	CT3	Beth Israel Deaconess to Logan Airport	Yes	Yes	20	30	20	X	30	30
CR	Rockport	Rockport - North Station	No		35	120	35	90	L	L
CR	Newburyport	Newburyport - North Station	Yes		35	120	35	75	L	L
CR	Haverhill	Haverhill - North Station	No		30	100	35	L	L	L
CR	Lowell	Lowell - North Station	No		30	60	30	60	120	120
CR	Fitchburg	Fitchburg - North Station	No		30	110	45	120	L	L
CR	Worcester	Worcester - South Station	No		30	L	40	L	L	L
CR	Needham	Needham - South Station	Yes		35	120	35	60	120	X
CR	Franklin	Franklin - South Station	No		30	110	30	85	120	120
CR	Providence	Providence - South Station	Yes		35	120	35	100	120	120
CR	Stoughton	Stoughton - South Station	Yes		40	L	35	90	X	X
CR	Fairmount	Readville - South Station	Yes		30	60	30	L	X	X
CR	Middleborough	Middleborough/Lakeville - South Station	No		40	120	45	90	L	L
CR	Plymouth/Kingston	Plymouth/Kingston - South Station	No		40	65	40	80	L	L
CR	Green - B	Boston College - Government Center	Yes		5	8	5	10	6	5

Table A-1A (Expanded)
Scheduled Frequency in Minutes

L = Limited Service **X = No Service**

Mode	Route	Route Name	Minority	Low Income	AM Peak	Midday	PM Peak	Evening	Saturday	Sunday
RT	Green - C	Cleveland Circle - Government Center	Yes		6	6	6	10	5	7
RT	Green - D	Riverside - Lechmere	No		5	10	5	10	6	7
RT	Green - E	Heath Street - Lechmere	Yes		9	9	9	10	7	5
RT	Green Central Sub.	BC/Cleveland Circle/Riverside/Heath Street - Lechmere	Yes		2	2	2	3	2	2
RT	Red - Mattapan	Mattapan - Ashmont	No		6	10	6	12	8	11
RT	Red - Ashmont	Ashmont - Alewife	Yes		8	10	8	12	13	14
RT	Red - Braintree	Braintree - Alewife	Yes		7	12	7	12	13	14
RT	Red - Cambridge	Ashmont/Braintree - Alewife	Yes		4	5	4	6	7	7
RT	Orange	Oak Grove - Forest Hills	Yes		5	8	5	13	10	13
RT	Blue	Wonderland - Bowdoin	Yes		4	9	4	13	8	10

Table A-2A (Expanded)
Average Vehicle Loading During Peak 30 Minutes (Typical Weekday)

Mode	Route	Route Name	Minority	Low Income	Time	Direction	Load Factor	Crowd Factor
Bus/TT	1	Harvard/Holyoke Gate to Dudley Sta	Yes	No	16:50-17:20	Outbound	131.25%	93.75%
Bus/TT	3	City Pt. to Chinatown via Boston Marine Ind Pk	No	Yes	16:55-17:25	Inbound	98.75%	70.54%
Bus/TT	4	N Sta to World Trade Ctr	Yes	No	7:50-8:20	Inbound	40.00%	28.57%
Bus/TT	5	City Point to McCormack Housing	No	No	12:50-13:20	Inbound	65.00%	46.43%
Bus/TT	6	Boston Marine Ind Park to Haymarket via S Sta	No	No	06:30	Outbound	100.00%	71.43%
Bus/TT	7	City Point to Otis & Summer Sts	No	No	8:00-8:30	Inbound	158.75%	113.39%
Bus/TT	8	Harbor Point/UMass to Kenmore Sta	Yes	Yes	8:31-9:00	Inbound	121.25%	86.61%
Bus/TT	9	City Point to Copley Sq	No	No	7:00-7:30	Inbound	127.50%	91.07%
Bus/TT	10	City Point to Copley Sq via Andrew Sta	Yes	Yes	7:05-7:35	Outbound	152.50%	108.93%
Bus/TT	11	City Point (via Bayview) to Downtown	No	Yes	7:26-7:56	Inbound	100.00%	71.43%
Bus/TT	14	Roslindale Sq to Dudley Sta	Yes	Yes	06:30	Inbound	97.50%	69.64%
Bus/TT	15	Kane Sq or Fields Corner Sta to Ruggles Sta	Yes	Yes	6:45-7:15	Inbound	127.50%	91.07%
Bus/TT	16	Forest Hills Sta to Andrew Sta or UMass	Yes	Yes	14:00-14:29	Inbound	165.00%	117.86%
Bus/TT	17	Fields Corner Sta to Andrew Sta	Yes	Yes	16:42-17:11	Outbound	113.33%	80.95%
Bus/TT	18	Ashmont Sta to Andrew Sta	Yes	Yes	8:00	Outbound	55.00%	39.29%
Bus/TT	19	Fields Corner Sta to Ruggles Sta	Yes	Yes	7:00-7:30	Inbound	79.50%	56.79%
Bus/TT	20	Fields Corner to Fields Corner via Neponset and Adams	Yes	No	15:00-15:30	Inbound	76.25%	54.46%
Bus/TT	21	Ashmont Sta to Forest Hills Sta	Yes	No	6:00-6:30	Inbound	157.50%	112.50%
Bus/TT	22	Ashmont Sta to Ruggles Sta	Yes	Yes	17:00-17:30	Outbound	120.00%	85.71%
Bus/TT	23	Ashmont Sta to Ruggles Sta via Washington St	Yes	Yes	6:50-7:20	Inbound	128.21%	91.58%
Bus/TT	24	Wakefield Ave.& Truman Pkwy to Mattapan or Ashmont Sta	Yes	No	6:30-7:00	Outbound	108.75%	77.68%
Bus/TT	26	Ashmont Sta to Norfolk & Morton Belt Line	Yes	No	6:23-6:53	Outbound	94.17%	67.26%
Bus/TT	27	Mattapan Sta to Ashmont Sta	Yes	No	6:15-6:45	Inbound	51.25%	36.61%
Bus/TT	28	Mattapan Sta to Ruggles Sta	Yes	Yes	6:40-7:10	Inbound	117.50%	83.93%
Bus/TT	29	Mattapan Sta to Jackson Sq, Sta	Yes	Yes	6:01-6:31	Inbound	118.75%	84.82%
Bus/TT	30	Mattapan Sta to Roslindale Sq	Yes	No	7:00-7:30	Inbound	140.00%	100.00%
Bus/TT	31	Mattapan Sta to Forest Hills Sta	Yes	No	7:10-7:40	Inbound	121.88%	87.05%
Bus/TT	32	Wolcott Sq to Forest Hills Sta	Yes	Yes	6:40-7:10	Inbound	108.75%	77.68%

Table A-2A (Expanded)
Average Vehicle Loading During Peak 30 Minutes (Typical Weekday)

Mode	Route	Route Name	Minority	Low Income	Time	Direction	Load Factor	Crowd Factor
Bus/TT	33	Dedham Line to Mattapan Sta	Yes	No	7:15	Outbound	100.00%	71.43%
Bus/TT	34	Dedham Line to Forest Hills Sta	No	No	6:45-7:15	Inbound	115.63%	82.59%
Bus/TT	34E	Walpole Ctr to Forest Hills Sta via Washington St	No	No	13:45-14:15	Outbound	135.00%	96.43%
Bus/TT	35	Dedham Mall/Stimson St. to Forest Hills Sta	No	No	15:00-15:30	Outbound	132.50%	94.64%
Bus/TT	36	Charles River Loop or V.A. Hosp to Forest Hills Sta	No	No	17:20-17:50	Outbound	108.33%	77.38%
Bus/TT	37	Baker & Vt Sts to Forest Hills Sta	No	No	17:10-17:40	Outbound	89.17%	63.69%
Bus/TT	38	Wren St to Forest Hills Sta	Yes	No	17:20-17:50	Outbound	68.75%	49.11%
Bus/TT	39	Forest Hills Sta to Back Bay Sta	Yes	Yes	7:05-7:35	Inbound	133.33%	95.24%
Bus/TT	40	Georgetowne to Forest Hills Sta	No	No	15:00-15:30	Outbound	115.00%	82.14%
Bus/TT	41	Centre & Eliot Sts to Dudley Sta	Yes	Yes	7:00-7:30	Outbound	76.25%	54.46%
Bus/TT	42	Forest Hills Sta to Ruggles Sta	Yes	Yes	7:10-7:40	Outbound	106.67%	76.19%
Bus/TT	43	Ruggles Sta to Park & Tremont Sts	Yes	Yes	8:00-8:30	Inbound	107.50%	76.79%
Bus/TT	44	Jackson Sq Sta to Ruggles Sta	Yes	Yes	6:40-7:10	Inbound	136.67%	97.62%
Bus/TT	45	Franklin Park Zoo to Ruggles Sta	Yes	Yes	14:04-14:33	Outbound	121.67%	86.90%
Bus/TT	46	Heath St & S Huntington Ave to Dudley Sta	Yes	Yes	15:00-15:30	Inbound	41.25%	29.46%
Bus/TT	47	Central Sq, Cambridge to Broadway Sta	Yes	Yes	16:20-16:50	Outbound	141.25%	100.89%
Bus/TT	48	Centre & Eliot Sts to Jamaica Plain Loop	Yes	No	14:00-14:30	Inbound	41.25%	29.46%
Bus/TT	49	Dudley Sta to Downtown	Yes	Yes	17:02-17:32	Outbound	104.58%	74.70%
Bus/TT	50	Cleary Sq to Forest Hills Sta	Yes	No	6:50-7:20	Inbound	95.00%	67.86%
Bus/TT	51	Reservoir (Cleveland Cir) to Forest Hills Sta	No	No	7:30-8:00	Outbound	113.75%	81.25%
Bus/TT	52	Dedham Mall or Charles River Loop to Watertown Sq	No	No	6:45-7:15	Inbound	110.00%	78.57%
Bus/TT	55	Jersey & Queensbury Sts to Copley Sq or Park	Yes	Yes	8:20-8:49	Inbound	96.25%	68.75%
Bus/TT	57	Watertown Sq to Kenmore Sta	Yes	Yes	6:35-7:04	Outbound	141.25%	100.89%
Bus/TT	59	Needham Junction to Watertown Sq	No	No	7:35-8:05	Outbound	31.00%	22.14%
Bus/TT	60	Chesnut Hill to Kenmore Sta	Yes	No	8:00-8:30	Inbound	93.75%	66.96%
Bus/TT	62	Bedford V.A. Hospital to Alewife Sta	No	No	7:30-8:00	Inbound	126.25%	90.18%
Bus/TT	64	Oak Sq to University Pk or Kendall/MIT via Central Sq	Yes	No	16:45-17:14	Outbound	93.75%	66.96%
Bus/TT	65	Brighton Ctr to Kenmore Sta	Yes	Yes	7:25-7:54	Inbound	165.00%	117.86%

Table A-2A (Expanded)
Average Vehicle Loading During Peak 30 Minutes (Typical Weekday)

Mode	Route	Route Name	Minority	Low Income	Time	Direction	Load Factor	Crowd Factor
Bus/TT	66	Harvard Sq to Dudley Sta	Yes	No	8:15-8:44	Outbound	130.63%	93.30%
Bus/TT	67	Turkey Hill to Alewife Sta	No	No	7:23-7:53	Inbound	115.00%	82.14%
Bus/TT	68	Harvard Sq to Kendall/MIT via Broadway	Yes	No	7:30	Outbound	127.50%	91.07%
Bus/TT	69	Harvard/Holyoke Gate to Lechmere Sta	Yes	No	7:12-7:42	Outbound	116.50%	83.21%
Bus/TT	70	Cedarwood or Watertown Sq to University Pk	Yes	No	12:45-13:14	Inbound	147.50%	105.36%
Bus/TT	70A	N Waltham to University Pk via Arsenal St & Western Ave	No	No	16:30-16:59	Outbound	165.00%	117.86%
Bus/TT	71	Watertown Square to Harvard Station	No	No	17:25-17:55	Outbound	136.88%	97.77%
Bus/TT	72	Huron Ave to Harvard Sta	Yes	No	7:35-8:05	Inbound	70.83%	50.60%
Bus/TT	73	Waverly Sq to Harvard Sta	No	No	17:30-18:00	Outbound	132.14%	94.39%
Bus/TT	74	Belmont Ctr to Harvard Sta	Yes	No	17:10-17:40	Outbound	96.25%	68.75%
Bus/TT	75	Belmont Ctr to Harvard Sta	Yes	No	07:47	Inbound	107.50%	76.79%
Bus/TT	76	Hanscom AFB to Alewife Sta via Mass Ave	No	No	7:15-7:45	Inbound	91.25%	65.18%
Bus/TT	77	Arlington Heights to Harvard Sta	No	No	7:50-8:20	Inbound	108.50%	77.50%
Bus/TT	77A	N Cambridge to Harvard Sta	Yes	No	6:29-7:01	Inbound	42.50%	30.36%
Bus/TT	78	Arlmont Village to Harvard Sta	No	No	17:20-17:50	Outbound	97.50%	69.64%
Bus/TT	79	Arlington Heights to Alewife Sta	No	No	7:40-8:10	Inbound	88.33%	63.10%
Bus/TT	80	Arlington Ctr to Lechmere Sta	Yes	No	17:15-17:45	Outbound	100.83%	72.02%
Bus/TT	83	Rindge Ave to Central Sq, Cambridge	Yes	Yes	7:10-7:40	Inbound	100.00%	71.43%
Bus/TT	84	Arlmont Village to Alewife Sta	No	No	7:14-7:44	Inbound	77.50%	55.36%
Bus/TT	85	Spring Hill to Kendall/MIT Sta	Yes	Yes	08:40	Inbound	117.50%	83.93%
Bus/TT	86	Sullivan Sq Sta to Reservoir (Cleveland Cir)	Yes	No	16:30-17:00	Outbound	113.75%	81.25%
Bus/TT	87	Arlington Ctr or Clarendon Hill to Lechmere Sta	Yes	No	17:00-17:30	Outbound	112.50%	80.36%
Bus/TT	88	Clarendon Hill to Lechmere Sta	Yes	Yes	7:00-7:30	Inbound	95.00%	67.86%
Bus/TT	89	Clarendon Hill to Sullivan Sq	Yes	No	17:05-17:35	Outbound	116.25%	83.04%
Bus/TT	90	Davis Sq to Wellington Sta	Yes	Yes	14:10-14:40	Outbound	100.00%	71.43%
Bus/TT	91	Sullivan Sq Sta to Central Sq,Cambridge	Yes	Yes	16:45-17:15	Outbound	113.75%	81.25%
Bus/TT	92	Assembly Sq Mall to Downtown via Main St.	No	No	7:30-8:00	Inbound	103.13%	73.66%
Bus/TT	93	Sullivan Sq Sta to Downtown via Bunker Hill St	No	No	17:40-18:10	Inbound	90.00%	64.29%

Table A-2A (Expanded)
Average Vehicle Loading During Peak 30 Minutes (Typical Weekday)

Mode	Route	Route Name	Minority	Low Income	Time	Direction	Load Factor	Crowd Factor
Bus/TT	94	Medford Sq to Davis Sq Sta	No	No	17:30-18:00	Outbound	86.25%	61.61%
Bus/TT	95	W Medford to Sullivan Sq Sta	No	No	17:00-17:30	Outbound	75.00%	53.57%
Bus/TT	96	Medford Squ to Harvard Sta	No	No	17:30-18:00	Outbound	113.75%	81.25%
Bus/TT	97	Malden Ctr Sta to Wellington Sta	No	No	7:35	Outbound	60.00%	42.86%
Bus/TT	99	Boston Regional Med Ctr to Wellington Sta	No	No	7:00-7:30	Outbound	55.83%	39.88%
Bus/TT	100	Elm St to Wellington Sta	No	No	7:30-8:00	Inbound	95.00%	67.86%
Bus/TT	101	Malden Center Sta - Sullivan Sq Sta	No	No	7:00-7:30	Inbound	75.50%	53.93%
Bus/TT	104	Malden Ctr Sta to Sullivan Sq Sta	Yes	No	7:29-7:59	Inbound	65.00%	46.43%
Bus/TT	105	Malden Ctr Sta to Sullivan Sq Sta	Yes	No	7:00-7:30	Inbound	80.00%	57.14%
Bus/TT	106	Lebanon St, Malden to Wellington Sta	Yes	No	14:08-14:37	Outbound	81.25%	58.04%
Bus/TT	108	Linden Sq to Wellington Sta	No	No	7:00-7:30	Inbound	117.00%	83.57%
Bus/TT	109	Linden Sq to Sullivan Sq Sta	No	No	17:15-17:45	Inbound	115.00%	82.14%
Bus/TT	110	Wonderland or Park Ave. & Broadway to Wellington Sta	No	No	7:20-7:50	Inbound	115.83%	82.74%
Bus/TT	111	Woodlawn to Haymarket Sta	Yes	Yes	7:06-7:36	Inbound	114.17%	81.55%
Bus/TT	112	Wellington Sta to Wood Island Sta	Yes	Yes	6:50	Inbound	97.50%	69.64%
Bus/TT	114	Bellingham Sq to Maverick St	Yes	Yes	13:15-13:44	Inbound	115.00%	82.14%
Bus/TT	116	Wonderland Sta to Maverick Sta	Yes	Yes	16:40-17:10	Outbound	173.75%	124.11%
Bus/TT	117	Wonderland Sta to Maverick Sta	Yes	Yes	17:10-17:40	Outbound	167.50%	119.64%
Bus/TT	119	Northgate to Beachmont Sta	No	No	7:30	Inbound	107.50%	76.79%
Bus/TT	120	Orient Heights to Maverick Sta	Yes	Yes	12:00-12:30	Outbound	92.50%	66.07%
Bus/TT	121	Wood Island Sta to Maverick Sta	Yes	Yes	7:30-8:00	Inbound	55.00%	39.29%
Bus/TT	130	Lebanon St, Melrose to Malden Ctr Sta	No	No	7:45-8:15	Inbound	46.25%	33.04%
Bus/TT	131	Melrose Highlands to Malden Ctr Sta	No	No	7:30-8:00	Inbound	88.75%	63.39%
Bus/TT	132	Redstone Shopping Ctr to Malden Ctr Sta	No	No	7:00-7:30	Inbound	122.50%	87.50%
Bus/TT	134	N Woburn to Wellington Sta	No	No	16:40-17:10	Outbound	48.75%	34.82%
Bus/TT	136	Reading Depot to Malden Sta	No	No	7:40-8:10	Inbound	111.25%	79.46%
Bus/TT	137	Reading Depot to Malden Sta	No	No	7:45	Inbound	132.50%	94.64%
Bus/TT	170	Dudley Sta to Oak Park	Yes	Yes	16:15	Inbound	47.50%	33.93%

Table A-2A (Expanded)
Average Vehicle Loading During Peak 30 Minutes (Typical Weekday)

Mode	Route	Route Name	Minority	Low Income	Time	Direction	Load Factor	Crowd Factor
Bus/TT	210	Quincy Ctr Sta to N Quincy or Fields Corner	No	No	7:00-7:30	Outbound	55.00%	39.29%
Bus/TT	211	Quincy Ctr Sta to Squantum via Montclair	No	No	7:00-7:30	Outbound	82.50%	58.93%
Bus/TT	212	Quincy Ctr Sta to N Quincy Sta	No	No	7:35-8:05	Inbound	40.00%	28.57%
Bus/TT	214	Quincy Ctr Sta to Germantown	No	No	7:20-7:50	Outbound	90.00%	64.29%
Bus/TT	215	Quincy Ctr Sta to Ashmont Sta	No	No	7:20-7:50	Outbound	88.75%	63.39%
Bus/TT	216	Quincy Ctr Sta to Houghs Neck	No	No	14:40-15:10	Inbound	132.50%	94.64%
Bus/TT	217	Wollaston Beach to Ashmont Sta via Beale St	No	No	6:45-7:15	Inbound	37.50%	26.79%
Bus/TT	220	Quincy Ctr Sta to Hingham or Fort Point	No	No	16:40-17:10	Inbound	89.17%	63.69%
Bus/TT	221	Quincy Ctr Sta to Hingham or Fort Point	No	No	14:37	Inbound	117.50%	83.93%
Bus/TT	222	Quincy Ctr Sta to E Weymouth	No	No	16:30-17:00	Inbound	83.33%	59.52%
Bus/TT	225	Quincy Ctr Sta to Weymouth Landing	No	No	17:25-17:55	Inbound	117.50%	83.93%
Bus/TT	230	Quincy Ctr Sta to Brockton Line	No	No	7:00-7:30	Outbound	68.75%	49.11%
Bus/TT	236	Quincy Ctr Sta to S Shore Plaza	No	No	16:00-16:30	Outbound	50.00%	35.71%
Bus/TT	238	Quincy Ctr Sta to Holbrook/Randolph Commuter Rail Sta	No	No	15:15-15:45	Outbound	97.50%	69.64%
Bus/TT	240	Avon Line or Holbrook/Randolph Comm Rail Sta to Ashmont	No	No	6:45-7:15	Outbound	101.25%	72.32%
Bus/TT	245	Quincy Ctr Sta to Mattapan Sta via Pleasant St	No	No	15:00-15:30	Inbound	72.50%	51.79%
Bus/TT	325	Medford to Haymarket	No	No	7:40-8:10	Inbound	91.67%	65.48%
Bus/TT	326	W Medford to Haymarket Sta	No	No	17:04-17:34	Outbound	91.67%	65.48%
Bus/TT	350	N Burlington to Alewife Sta	No	No	8:00	Outbound	122.50%	87.50%
Bus/TT	351	Oak Park to Alewife Station Express	No	No	16:00-16:29	Inbound	75.00%	53.57%
Bus/TT	352	Burlington to Boston via Rts 128 & 93	No	No	16:55-17:25	Outbound	98.75%	70.54%
Bus/TT	354	Woburn Line to Boston via I-93	No	No	7:18-7:48	Inbound	107.50%	76.79%
Bus/TT	355	Mishawum Sta to Boston	No	No	6:15	Outbound	12.50%	8.93%
Bus/TT	411	Malden Center Station to Jack Satter House	No	No	7:00-7:29	Inbound	122.50%	87.50%
Bus/TT	425	Central Sq, Lynn to Wonderland via Linden Sq	No	No	7:30-8:00	Inbound	80.00%	57.14%
Bus/TT	426	Central Sq,Lynn & E Saugus to Haymarket Sta	No	No	17:20-17:50	Outbound	95.00%	67.86%
Bus/TT	427	Granada Highlands to Haymarket via Linden Sq	No	No	17:22	Outbound	50.00%	35.71%
Bus/TT	428	Oaklandvale to Haymarket via Cliftondale Sq	No	No	7:30	Inbound	62.50%	44.64%

Table A-2A (Expanded)
Average Vehicle Loading During Peak 30 Minutes (Typical Weekday)

Mode	Route	Route Name	Minority	Low Income	Time	Direction	Load Factor	Crowd Factor
Bus/TT	429	Central Sq, Lynn to Linden Sq	No	No	7:00	Inbound	127.50%	91.07%
Bus/TT	430	Saugus Ironworks to Malden Center Sta	No	No	17:00-17:30	Outbound	86.25%	61.61%
Bus/TT	433	Pine Hill to Central Sq, Lynn	Yes	Yes	7:45	Outbound	27.50%	19.64%
Bus/TT	435	Lynn to Danvers via North Shore & Liberty Tree Malls	No	No	18:30	Outbound	150.00%	107.14%
Bus/TT	436	Goodwin Cir to Central Sq, Lynn	No	No	7:20	Inbound	150.00%	107.14%
Bus/TT	437	Lake Shore Park to Central Sq, Lynn	No	No	7:10	Outbound	62.50%	44.64%
Bus/TT	439	Central Sq, Lynn to Bass Point, Nahant	No	No	6:00-6:30	Outbound	17.50%	12.50%
Bus/TT	441	Marblehead to Haymarket or Dtwn Xing via Paradise St	No	No	17:26-17:56	Outbound	118.75%	84.82%
Bus/TT	442	Marblehead to Haymarket via Humphrey St	No	No	18:49	Outbound	140.00%	100.00%
Bus/TT	448	Marblehead to Dntn Xing via Paradise Rd	No	No	6:58-7:28	Inbound	80.00%	57.14%
Bus/TT	449	Marblehead to Downtown Xing via Humphrey St	No	No	7:58	Inbound	102.50%	73.21%
Bus/TT	450	Salem Depot to Haymarket Sta	No	Yes	16:40-17:10	Outbound	59.38%	42.41%
Bus/TT	451	N Beverly to Salem Depot	No	No	7:00	Inbound	75.00%	53.57%
Bus/TT	455	Salem Depot to Haymarket via Loring Ave & Central Sq, Lynn	Yes	No	7:30	Outbound	115.00%	82.14%
Bus/TT	458	Salem Depot to Danvers Sq via Liberty Tree Mall	No	No	15:30-15:59	Outbound	42.50%	30.36%
Bus/TT	459	Salem Depot to Dntn Xing via Humphrey St,	Yes	No	6:30	Inbound	127.50%	91.07%
Bus/TT	468	Salem Depot to Danvers Sq	No	No	7:00-7:29	Inbound	27.50%	19.64%
Bus/TT	500	Riverside to Downtown Boston	No	No	19:00	Outbound	90.00%	64.29%
Bus/TT	501	Brighton Ctr to Downtown Boston	Yes	No	19:05	Outbound	167.50%	119.64%
Bus/TT	502	Watertown Sq to Copley Sq	No	No	8:00-8:30	Inbound	139.38%	99.55%
Bus/TT	504	Watertown Sq to Downtown Boston	No	No	7:55-8:25	Inbound	146.00%	104.29%
Bus/TT	505	Central Sq, Waltham to Dntn Boston	No	No	7:34-8:04	Inbound	106.50%	76.07%
Bus/TT	553	Roberts to Dntn Boston via Newton Corner & Mass Pike	No	No	7:18-7:48	Inbound	93.75%	66.96%
Bus/TT	554	Waverley Sq to Downtown Boston	No	No	7:00	Inbound	107.50%	76.79%
Bus/TT	556	Waltham Hlds. to Downtown Boston via Mass Pike	No	No	17:25	Outbound	110.00%	78.57%
Bus/TT	558	Auburndale to Downtown Boston via Newton Cnr & Mass Pike	No	No	7:30	Inbound	167.50%	119.64%
Bus/TT	CT1	Central Sq, Cambridge to BU Medical Ctr	Yes	No	16:50-17:19	Outbound	131.25%	93.75%
Bus/TT	CT2	Kendall/MIT Station to Ruggles Sta	Yes	Yes	16:15-16:44	Inbound	81.25%	58.04%

Table A-2A (Expanded)
Average Vehicle Loading During Peak 30 Minutes (Typical Weekday)

Mode	Route	Route Name	Minority	Low Income	Time	Direction	Load Factor	Crowd Factor
Bus/TT	CT3	Beth Israel Deaconess to Logan Airport	Yes	Yes	7:51-8:20	Outbound	112.50%	80.36%
CR	Rockport	Rockport - North Station	No		7:30-8:00	Inbound	97.10%	97.10%
CR	Newburyport	Newburyport - North Station	Yes		7:40-8:10	Inbound	73.60%	73.60%
CR	Haverhill	Haverhill - North Station	No		7:30-8:00	Inbound	80.9%	80.9%
CR	Lowell	Lowell - North Station	No		8:10-8:40	Inbound	95.5%	95.5%
CR	Fitchburg	Fitchburg - North Station	No		7:50-8:20	Inbound	88.8%	88.8%
CR	Worcester	Worcester - South Station	No		8:00-8:30	Inbound	82.0%	82.0%
CR	Needham	Needham - South Station	Yes		8:15-8:45	Inbound	86.1%	86.1%
CR	Franklin	Franklin - South Station	No		7:30-8:00	Inbound	95.7%	95.7%
CR	Providence	Providence - South Station	Yes		7:45-8:15	Inbound	113.5%	113.5%
CR	Stoughton	Stoughton - South Station	Yes		7:05-7:35	Inbound	76.40%	76.40%
CR	Fairmount	Readville - South Station	Yes		8:00-8:30	Inbound	29.4%	29.4%
CR	Middleborough	Middleborough/Lakeville - South Station	No		7:45-8:15	Inbound	109.0%	109.0%
CR	Plymouth/Kingston	Plymouth/Kingston - South Station	No		8:00-8:30	Inbound	124.3%	124.3%
RT	Green - B	Boston College - Government Center	Yes		17:30-18:00	Outbound	168.48%	76.58%
RT	Green - C	Cleveland Circle - Government Center	Yes		7:45-8:15	Inbound	204.57%	92.98%
RT	Green - D	Riverside - Lechmere	No		8:00-8:30	Inbound	209.24%	95.11%
RT	Green - E	Heath Street - Lechmere	Yes		7:30-8:00	Outbound	132.88%	60.40%
RT	Green Central Sub.	BC/Cleveland Circle/Riverside/Heath Street - Lechmere	Yes		8:30-9:00	Eastbound	178.42%	81.10%
RT	Red - Mattapan	Mattapan - Ashmont	No		5:30-6:00	Outbound	154.15%	70.07%
RT	Red - Ashmont	Ashmont - Alewife	Yes		8:15-8:45	Northbound	153.50%	56.85%
RT	Red - Braintree	Braintree - Alewife	Yes		7:30-8:00	Northbound	236.93%	87.75%
RT	Red - Cambridge	Ashmont/Braintree - Alewife	Yes		17:00-17:30	Northbound	176.25%	65.28%
RT	Orange	Oak Grove - Forest Hills	Yes		8:00-8:30	Southbound	183.50%	81.55%
RT	Blue	Wonderland - Bowdoin	Yes		8:30-9:00	Westbound	204.37%	90.83%

Table A-2A (Expanded)
Average Vehicle Loading During Peak 30 Minutes (Typical Saturday)

Mode	Route	Route Name	Minority	Low Income	Time	Direction	Load Factor	Crowd Factor
Bus/TT	1	Harvard/Holyoke Gate to Dudley Sta	Yes	No	15:30-16:00	Outbound	132.50%	94.64%
Bus/TT	5	City Point to McCormack Housing	No	No	11:15	Outbound	70.00%	50.00%
Bus/TT	7	City Point to Otis & Summer Sts	No	No	14:40-15:10	Inbound	28.75%	20.54%
Bus/TT	8	Harbor Point/UMass to Kenmore Sta	Yes	Yes	11:10	Outbound	125.00%	89.29%
Bus/TT	9	City Point to Copley Sq	No	No	10:10-10:30	Inbound	82.50%	58.93%
Bus/TT	10	City Point to Copley Sq via Andrew Sta	Yes	Yes	17:30-18:00	Inbound	60.00%	42.86%
Bus/TT	11	City Point (via Bayview) to Downtown	No	Yes	14:40-15:10	Outbound	88.75%	63.39%
Bus/TT	14	Roslindale Sq to Dudley Sta	Yes	Yes	12:30	Inbound	70.00%	50.00%
Bus/TT	15	Kane Sq or Fields Corner Sta to Ruggles Sta	Yes	Yes	15:30-16:00	Inbound	143.75%	102.68%
Bus/TT	16	Forest Hills Sta to Andrew Sta or UMass	Yes	Yes	21:30	Outbound	120.00%	85.71%
Bus/TT	17	Fields Corner Sta to Andrew Sta	Yes	Yes	10:25-10:54	Inbound	0.80	57.14%
Bus/TT	18	Ashmont Sta to Andrew Sta	Yes	Yes	9:30-9:59	Inbound	40.00%	28.57%
Bus/TT	20	Fields Corner Sta to Fields Corner Sta	Yes	No	16:20-16:50	Inbound	37.50%	26.79%
Bus/TT	21	Ashmont Sta to Forest Hills Sta	Yes	No	11:27	Inbound	92.50%	66.07%
Bus/TT	22	Ashmont Sta to Ruggles Sta	Yes	Yes	17:16-17:46	Outbound	118.33%	84.52%
Bus/TT	23	Ashmont Sta to Ruggles Sta via Washington St	Yes	Yes	11:13-11:43	Inbound	141.67%	101.19%
Bus/TT	24	Wakefield Ave.& Truman Pkwy to Mattapan or Ashmont Sta	Yes	No	12:20	Outbound	90.00%	64.29%
Bus/TT	26	Ashmont Sta to Norfolk & Morton Belt Line	Yes	No	18:05	Inbound	117.50%	83.93%
Bus/TT	27	Mattapan Sta to Ashmont Sta	Yes	No	13:15	Inbound	70.00%	50.00%
Bus/TT	28	Mattapan Sta to Ruggles Sta	Yes	Yes	17:14-17:44	Outbound	145.00%	103.57%
Bus/TT	29	Mattapan Sta to Jackson Sq, Sta	Yes	Yes	20:10	Outbound	85.00%	60.71%
Bus/TT	30	Mattapan Sta to Roslindale Sq	Yes	No	11:40	Outbound	80.00%	57.14%
Bus/TT	31	Mattapan Sta to Forest Hills Sta	Yes	No	20:25	Outbound	102.50%	73.21%
Bus/TT	32	Wolcott Sq to Forest Hills Sta	Yes	Yes	7:45-8:15	Inbound	107.50%	76.79%
Bus/TT	33	Dedham Line to Mattapan Sta	Yes	No	11:45	Inbound	47.50%	33.93%
Bus/TT	34	Dedham Line to Forest Hills Sta	No	No	17:45-18:15	Outbound	106.25%	75.89%
Bus/TT	34E	Walpole Ctr to Forest Hills Sta via Washington St	No	No	7:15	Outbound	160.00%	114.29%
Bus/TT	35	Dedham Mall/Stimson St. to Forest Hills Sta	No	No	11:42	Outbound	97.50%	69.64%

Table A-2A (Expanded)
Average Vehicle Loading During Peak 30 Minutes (Typical Saturday)

Mode	Route	Route Name	Minority	Low Income	Time	Direction	Load Factor	Crowd Factor
Bus/TT	36	Charles River Loop or V.A. Hosp to Forest Hills Sta	No	No	19:30	Outbound	105.00%	75.00%
Bus/TT	37	Baker & Vt Sts to Forest Hills Sta	No	No	12:20	Outbound	57.50%	41.07%
Bus/TT	38	Wren St to Forest Hills Sta	Yes	No	16:40	Outbound	47.50%	33.93%
Bus/TT	39	Forest Hills Sta to Back Bay Sta	Yes	Yes	9:23-9:53	Inbound	101.25%	72.32%
Bus/TT	40	Georgetowne to Forest Hills Sta	No	No	13:30	Inbound	92.50%	66.07%
Bus/TT	41	Centre & Eliot Sts to Dudley Sta	Yes	Yes	12:40	Outbound	45.00%	32.14%
Bus/TT	42	Forest Hills Sta to Ruggles Sta	Yes	Yes	13:05-13:35	Inbound	61.25%	43.75%
Bus/TT	43	Ruggles Sta to Park & Tremont Sts	Yes	Yes	12:05-12:35	Outbound	91.25%	65.18%
Bus/TT	44	Jackson Sq Sta to Ruggles Sta	Yes	Yes	14:05-14:35	Outbound	75.00%	53.57%
Bus/TT	45	Franklin Park Zoo to Ruggles Sta	Yes	Yes	20:00	Outbound	92.50%	66.07%
Bus/TT	46	Heath St & S Huntington Ave to Dudley Sta	Yes	Yes	14:30	Inbound	42.50%	30.36%
Bus/TT	47	Central Sq, Cambridge to Broadway Sta	Yes	Yes	19:10-19:39	Inbound	67.50%	48.21%
Bus/TT	48	Centre & Eliot Sts to Jamaica Plain Loop	Yes	No	11:30	Inbound	32.50%	23.21%
Bus/TT	49	Dudley Sta to Downtown	Yes	Yes	9:47-10:16	Inbound	102.50%	73.21%
Bus/TT	50	Cleary Sq to Forest Hills Sta	Yes	No	17:25	Outbound	77.50%	55.36%
Bus/TT	51	Reservoir (Cleveland Cir) to Forest Hills Sta	No	No	9:47	Inbound	67.50%	48.21%
Bus/TT	52	Dedham Mall or Charles River Loop to Watertown Sq	No	No	17:00	Outbound	30.00%	21.43%
Bus/TT	55	Jersey & Queensbury Sts to Copley Sq or Park	Yes	Yes	9:15-9:44	Inbound	40.00%	28.57%
Bus/TT	57	Watertown Sq to Kenmore Sta	Yes	Yes	16:09-16:38	Outbound	68.75%	49.11%
Bus/TT	59	Needham Junction to Watertown Sq	No	No	15:20	Inbound	40.00%	28.57%
Bus/TT	60	Chesnut Hill to Kenmore Sta	Yes	No	9:00	Inbound	47.50%	33.93%
Bus/TT	62	Bedford V.A. Hospital to Alewife Sta	No	No	16:00	Outbound	75.00%	53.57%
Bus/TT	64	Oak Sq to University Pk or Kendall/MIT via Central Sq	Yes	No	11:50	Inbound	75.00%	53.57%
Bus/TT	65	Brighton Ctr to Kenmore Sta	Yes	Yes	13:19	Inbound	55.00%	39.29%
Bus/TT	66	Harvard Sq to Dudley Sta	Yes	No	13:14-13:45	outbound	123.75%	88.39%
Bus/TT	69	Harvard/Holyoke Gate to Lechmere Sta	Yes	No	13:15-13:45	Inbound	77.50%	55.36%
Bus/TT	70	Cedarwood or Watertown Sq to University Pk	Yes	No	8:45-9:14	outbound	157.50%	112.50%
Bus/TT	70A	N Waltham to University Pk via Arsenal St & Western Ave	No	No	7:20-7:49	outbound	145.00%	103.57%

Table A-2A (Expanded)
Average Vehicle Loading During Peak 30 Minutes (Typical Saturday)

Mode	Route	Route Name	Minority	Low Income	Time	Direction	Load Factor	Crowd Factor
Bus/TT	71	Watertown Square to Harvard Station	No	No	19:05-19:35	Outbound	72.50%	51.79%
Bus/TT	72	Huron Ave to Harvard Sta	Yes	No	16:10-16:40	Outbound	30.00%	21.43%
Bus/TT	73	Waverly Sq to Harvard Sta	No	No	23:15	Outbound	105.00%	75.00%
Bus/TT	74	Belmont Ctr to Harvard Sta	Yes	No	15:35	Inbound	52.50%	37.50%
Bus/TT	75	Belmont Ctr to Harvard Sta	Yes	No	15:05	Inbound	57.50%	41.07%
Bus/TT	76	Hanscom AFB to Alewife Sta via Mass Ave	No	No	14:30	Outbound	57.50%	41.07%
Bus/TT	77	Arlington Heights to Harvard Sta	No	No	15:42-16:12	Outbound	80.00%	57.14%
Bus/TT	78	Arlmont Village to Harvard Sta	No	No	16:30	Outbound	82.50%	58.93%
Bus/TT	80	Arlington Ctr to Lechmere Sta	Yes	No	13:30	Inbound	95.00%	67.86%
Bus/TT	83	Rindge Ave to Central Sq, Cambridge	Yes	Yes	19:00	Inbound	87.50%	62.50%
Bus/TT	86	Sullivan Sq Sta to Reservoir (Cleveland Cir)	Yes	No	10:55	Outbound	102.50%	73.21%
Bus/TT	87	Arlington Ctr or Clarendon Hill to Lechmere Sta	Yes	No	12:20-12:50	Inbound	70.00%	50.00%
Bus/TT	88	Clarendon Hill to Lechmere Sta	Yes	Yes	14:10-14:40	Inbound	76.25%	54.46%
Bus/TT	89	Clarendon Hill to Sullivan Sq	Yes	No	10:35	Inbound	102.50%	73.21%
Bus/TT	90	Davis Sq to Wellington Sta	Yes	Yes	11:00	Outbound	62.50%	44.64%
Bus/TT	91	Sullivan Sq Sta to Central Sq,Cambridge	Yes	Yes	9:40-10:10	Inbound	57.50%	41.07%
Bus/TT	92	Assembly Sq Mall to Downtown via Main St.	No	No	12:45	Outbound	80.00%	57.14%
Bus/TT	93	Sullivan Sq Sta to Downtown via Bunker Hill St	No	No	14:20-14:50	Outbound	117.50%	83.93%
Bus/TT	94	Medford Sq to Davis Sq Sta	No	No	15:55	Outbound	55.00%	39.29%
Bus/TT	95	W Medford to Sullivan Sq Sta	No	No	16:15	Inbound	52.50%	37.50%
Bus/TT	96	Medford Squ to Harvard Sta	No	No	14:05	Inbound	65.00%	46.43%
Bus/TT	97	Malden Ctr Sta to Wellington Sta	No	No	15:00	Inbound	27.50%	19.64%
Bus/TT	99	Boston Regional Med Ctr to Wellington Sta	No	No	16:50	Outbound	37.50%	26.79%
Bus/TT	100	Elm St to Wellington Sta	No	No	17:30	Outbound	50.00%	35.71%
Bus/TT	101	Malden Center Sta - Sullivan Sq Sta	No	No	14:30	Outbound	87.50%	62.50%
Bus/TT	104	Malden Ctr Sta to Sullivan Sq Sta	Yes	No	16:00	Outbound	105.00%	75.00%
Bus/TT	105	Malden Ctr Sta to Sullivan Sq Sta	Yes	No	13:15	Inbound	60.00%	42.86%
Bus/TT	106	Lebanon St, Malden to Wellington Sta	Yes	No	17:35	Outbound	47.50%	33.93%

Table A-2A (Expanded)
Average Vehicle Loading During Peak 30 Minutes (Typical Saturday)

Mode	Route	Route Name	Minority	Low Income	Time	Direction	Load Factor	Crowd Factor
Bus/TT	108	Linden Sq to Wellington Sta	No	No	20:00	Outbound	67.50%	48.21%
Bus/TT	109	Linden Sq to Sullivan Sq Sta	No	No	21:45	Outbound	102.50%	73.21%
Bus/TT	110	Wonderland or Park Ave. & Broadway to Wellington Sta	No	No	11:30	Inbound	72.50%	51.79%
Bus/TT	111	Woodlawn to Haymarket Sta	Yes	Yes	8:00	Inbound	172.50%	123.21%
Bus/TT	112	Wellington Sta to Wood Island Sta	Yes	Yes	17:00	Outbound	90.00%	64.29%
Bus/TT	116	Wonderland Sta to Maverick Sta	Yes	Yes	16:00-16:29	outbound	175.00%	125.00%
Bus/TT	117	Wonderland Sta to Maverick Sta	Yes	Yes	14:30-14:59	outbound	177.50%	126.79%
Bus/TT	119	Northgate to Beachmont Sta	No	No	16:00	Inbound	102.50%	73.21%
Bus/TT	120	Orient Heights to Maverick Sta	Yes	Yes	17:00	Outbound	92.50%	66.07%
Bus/TT	130	Lebanon St, Melrose to Malden Ctr Sta	No	No	8:15	Inbound	27.50%	19.64%
Bus/TT	132	Redstone Shopping Ctr to Malden Ctr Sta	No	No	16:00	Outbound	27.50%	19.64%
Bus/TT	134	N Woburn to Wellington Sta	No	No	11:08	Inbound	70.00%	50.00%
Bus/TT	136	Reading Depot to Malden Sta	No	No	10:15	Inbound	50.00%	35.71%
Bus/TT	137	Reading Depot to Malden Sta	No	No	14:45	Inbound	57.50%	41.07%
Bus/TT	210	Quincy Ctr Sta to N Quincy or Fields Corner	No	No	14:25	Outbound	40.00%	28.57%
Bus/TT	211	Quincy Ctr Sta to Squantum via Montclair	No	No	16:30	Inbound	22.50%	16.07%
Bus/TT	212	Quincy Ctr Sta to N Quincy Sta	No	No	10:45	Outbound	25.00%	17.86%
Bus/TT	214	Quincy Ctr Sta to Germantown	No	No	9:40	Outbound	75.00%	53.57%
Bus/TT	215	Quincy Ctr Sta to Ashmont Sta	No	No	20:03	Inbound	127.50%	91.07%
Bus/TT	216	Quincy Ctr Sta to Houghs Neck	No	No	22:00	Inbound	110.00%	78.57%
Bus/TT	217/245	Wollaston Beach to Mattapan Sta via Beale St	No	No	9:40	Outbound	10.00%	7.14%
Bus/TT	220	Quincy Ctr Sta to Hingham or Fort Point	No	No	16:30	Inbound	72.50%	51.79%
Bus/TT	222	Quincy Ctr Sta to E Weymouth	No	No	10:45	Outbound	62.50%	44.64%
Bus/TT	225	Quincy Ctr Sta to Weymouth Landing	No	No	10:05	Outbound	75.00%	53.57%
Bus/TT	230	Quincy Ctr Sta to Brockton Line	No	No	11:05	Inbound	52.50%	37.50%
Bus/TT	236	Quincy Ctr Sta to S Shore Plaza	No	No	11:20	Inbound	40.00%	28.57%
Bus/TT	238	Quincy Ctr Sta to Holbrook/Randolph Commuter Rail Sta	No	No	14:15	Inbound	132.50%	94.64%
Bus/TT	240	Avon Line or Holbrook/Randolph Comm Rail Sta to Ashmont	No	No	14:50	Inbound	82.50%	58.93%

Table A-2A (Expanded)
Average Vehicle Loading During Peak 30 Minutes (Typical Saturday)

Mode	Route	Route Name	Minority	Low Income	Time	Direction	Load Factor	Crowd Factor
Bus/TT	245	Quincy Ctr Sta to Mattapan Sta via Pleasant St	No	No	15:10	Inbound	40.00%	28.57%
Bus/TT	350	N Burlington to Alewife Sta	No	No	10:30	Outbound	102.50%	73.21%
Bus/TT	411	Malden Center Station to Jack Satter House	No	No	12:55	Inbound	60.00%	42.86%
Bus/TT	426	Central Sq,Lynn & E Saugus to Haymarket Sta	No	No	15:00	Outbound	77.50%	55.36%
Bus/TT	429	Central Sq, Lynn to Linden Sq	No	No	12:40-15:09	Inbound	82.50%	58.93%
Bus/TT	430	Saugus Ironworks to Malden Center Sta	No	No	10:45	Outbound	142.50%	101.79%
Bus/TT	435	Lynn to Danvers via North Shore & Liberty Tree Malls	No	No	14:30	Inbound	117.50%	83.93%
Bus/TT	436	Goodwin Cir to Central Sq, Lynn	No	No	12:45-13:14	Inbound	77.50%	55.36%
Bus/TT	441	Marblehead to Haymarket or Dtwn Xing via Paradise St	No	No	10:17	Inbound	110.00%	78.57%
Bus/TT	442	Marblehead to Haymarket via Humphrey St	No	No	12:45	Outbound	95.00%	67.86%
Bus/TT	450	Salem Depot to Haymarket Sta	No	Yes	16:30	Outbound	65.00%	46.43%
Bus/TT	455	Salem Depot to Haymarket via Loring Ave & Central Sq, Lynn	Yes	No	16:20	Outbound	112.50%	80.36%
Bus/TT	504	Watertown Sq to Downtown Boston	No	No	12:40-13:09	Inbound	70.00%	50.00%
Bus/TT	553	Roberts to Dntn Boston via Newton Corner & Mass Pike	No	No	17:45-18:14	Outbound	25.00%	17.86%
Bus/TT	554	Waverley Sq to Downtown Boston	No	No	16:20-16:49	Outbound	25.00%	17.86%
Bus/TT	CT3	Beth Israel Deaconess to Logan Airport	Yes	Yes	4:15-4:43	Outbound	40.00%	28.57%
CR	Rockport	Rockport - North Station	No					
CR	Newburyport	Newburyport - North Station	Yes					
CR	Haverhill	Haverhill - North Station	No					
CR	Lowell	Lowell - North Station	No					
CR	Fitchburg	Fitchburg - North Station	No					
CR	Worcester	Worcester - South Station	No					
CR	Needham	Needham - South Station	Yes					
CR	Franklin	Franklin - South Station	No					
CR	Providence	Providence - South Station	Yes					
CR	Middleborough	Middleborough/Lakeville - South Station	No					
CR	Plymouth/Kingston	Plymouth/Kingston - South Station	No					
RT	Green - B	Boston College - Government Center	Yes					

Table A-2A (Expanded)
Average Vehicle Loading During Peak 30 Minutes (Typical Saturday)

Mode	Route	Route Name	Minority	Low Income	Time	Direction	Load Factor	Crowd Factor
RT	Green - C	Cleveland Circle - Government Center	Yes					
RT	Green - D	Riverside - Lechmere	No					
RT	Green - E	Heath Street - Lechmere	Yes					
RT	Green Central Sub.	BC/Cleveland Circle/Riverside/Heath Street - Lechmere	Yes					
RT	Red - Mattapan	Mattapan - Ashmont	No					
RT	Red - Ashmont	Ashmont - Alewife	Yes					
RT	Red - Braintree	Braintree - Alewife	Yes					
RT	Red - Cambridge	Ashmont/Braintree - Alewife	Yes					
RT	Orange	Oak Grove - Forest Hills	Yes					
RT	Blue	Wonderland - Bowdoin	Yes					

Table A-2A (Expanded)
Average Vehicle Loading During Peak 30 Minutes (Typical Sunday)

Mode	Route	Route Name	Minority	Low Income	Time	Direction	Load Factor	Crowd Factor
Bus/TT	1	Harvard/Holyoke Gate to Dudley Sta	Yes	No	16:50-17:20	Outbound	142.50%	101.79%
Bus/TT	8	Harbor Point/UMass to Kenmore Sta	Yes	Yes	12:33	Outbound	75.00%	53.57%
Bus/TT	9	City Point to Copley Sq	No	No	13:30	Inbound	82.50%	58.93%
Bus/TT	10	City Point to Copley Sq via Andrew Sta	Yes	Yes	14:30	Outbound	55.00%	39.29%
Bus/TT	11	City Point (via Bayview) to Downtown	No	Yes	16:08	Outbound	92.50%	66.07%
Bus/TT	15	Kane Sq or Fields Corner Sta to Ruggles Sta	Yes	Yes	16:20	Outbound	155.00%	110.71%
Bus/TT	16	Forest Hills Sta to Andrew Sta or UMass	Yes	Yes	9:55	Inbound	85.00%	60.71%
Bus/TT	17	Fields Corner Sta to Andrew Sta	Yes	Yes	14:00	Inbound	117.50%	83.93%
Bus/TT	18	Ashmont Sta to Andrew Sta	Yes	Yes	13:25-13:54	inbound	20.00%	14.29%
Bus/TT	20	Fields Corner Sta to Fields Corner Sta	Yes	No	18:35	Inbound	30.00%	21.43%
Bus/TT	22	Ashmont Sta to Ruggles Sta	Yes	Yes	18:10-18:40	Outbound	96.25%	68.75%
Bus/TT	23	Ashmont Sta to Ruggles Sta via Washington St	Yes	Yes	13:55-14:25	Inbound	118.75%	84.82%
Bus/TT	24	Wakefield Ave.& Truman Pkwy to Mattapan or Ashmont Sta	Yes	No	14:30	Inbound	62.50%	44.64%
Bus/TT	26	Ashmont Sta to Norfolk & Morton Belt Line	Yes	No	18:00	Inbound	82.50%	58.93%
Bus/TT	27	Mattapan Sta to Ashmont Sta	Yes	No	14:45	Inbound	47.50%	33.93%
Bus/TT	28	Mattapan Sta to Ruggles Sta	Yes	Yes	14:35-15:05	Inbound	133.33%	95.24%
Bus/TT	30	Mattapan Sta to Roslindale Sq	Yes	No	14:45	Inbound	35.00%	25.00%
Bus/TT	31	Mattapan Sta to Forest Hills Sta	Yes	No	19:45	Outbound	97.50%	69.64%
Bus/TT	32	Wolcott Sq to Forest Hills Sta	Yes	Yes	17:22	Outbound	142.50%	101.79%
Bus/TT	34	Dedham Line to Forest Hills Sta	No	No	8:35	Inbound	107.50%	76.79%
Bus/TT	34E	Walpole Ctr to Forest Hills Sta via Washington St	No	No	7:15	Outbound	132.50%	94.64%
Bus/TT	35	Dedham Mall/Stimson St. to Forest Hills Sta	No	No	17:10	Inbound	137.50%	98.21%
Bus/TT	36	Charles River Loop or V.A. Hosp to Forest Hills Sta	No	No	16:30	Outbound	85.00%	60.71%
Bus/TT	37/38	Baker & Vt Sts to Forest Hills Sta	No	No	9:45-10:14	Inbound	35.00%	25.00%
Bus/TT	39	Forest Hills Sta to Back Bay Sta	Yes	Yes	16:45-17:15	Outbound	100.00%	71.43%
Bus/TT	42	Forest Hills Sta to Ruggles Sta	Yes	Yes	14:50	Inbound	62.50%	44.64%
Bus/TT	43	Ruggles Sta to Park & Tremont Sts	Yes	Yes	16:25-16:55	Outbound	52.50%	37.50%
Bus/TT	44	Jackson Sq Sta to Ruggles Sta	Yes	Yes	18:35	Outbound	72.50%	51.79%

Table A-2A (Expanded)
Average Vehicle Loading During Peak 30 Minutes (Typical Sunday)

Mode	Route	Route Name	Minority	Low Income	Time	Direction	Load Factor	Crowd Factor
Bus/TT	45	Franklin Park Zoo to Ruggles Sta	Yes	Yes	18:55	Outbound	82.50%	58.93%
Bus/TT	47	Central Sq, Cambridge to Broadway Sta	Yes	Yes	12:30-12:59	Outbound	97.50%	69.64%
Bus/TT	49	Dudley Sta to Downtown	Yes	Yes	14:20-14:50	Inbound	67.50%	48.21%
Bus/TT	55	Jersey & Queensbury Sts to Copley Sq or Park	Yes	Yes	11:00	Inbound	50.00%	35.71%
Bus/TT	57	Watertown Sq to Kenmore Sta	Yes	Yes	19:30	Outbound	175.00%	125.00%
Bus/TT	60	Chesnut Hill to Kenmore Sta	Yes	No	11:30	Inbound	37.50%	26.79%
Bus/TT	64	Oak Sq to University Pk or Kendall/MIT via Central Sq	Yes	No	11:35	Inbound	62.50%	44.64%
Bus/TT	66	Harvard Sq to Dudley Sta	Yes	No	16:50-17:20	Outbound	121.25%	86.61%
Bus/TT	69	Harvard/Holyoke Gate to Lechmere Sta	Yes	No	19:30	Outbound	105.00%	75.00%
Bus/TT	70	Cedarwood or Watertown Sq to University Pk	Yes	No	16:50-17:20	Outbound	121.25%	86.61%
Bus/TT	71	Watertown Square to Harvard Station	No	No	13:55	Inbound	117.50%	83.93%
Bus/TT	72/75	Belmont Ctr to Harvard Sta	Yes	No	17:00	Outbound	60.00%	42.86%
Bus/TT	73	Waverly Sq to Harvard Sta	No	No	17:15	Outbound	117.50%	83.93%
Bus/TT	77	Arlington Heights to Harvard Sta	No	No	16:05-16:35	Outbound	103.75%	74.11%
Bus/TT	78	Arlmont Village to Harvard Sta	No	No	18:10	Outbound	65.00%	46.43%
Bus/TT	80	Arlington Ctr to Lechmere Sta	Yes	No	17:00	Outbound	70.00%	50.00%
Bus/TT	83	Rindge Ave to Central Sq, Cambridge	Yes	Yes	9:40	Inbound	70.00%	50.00%
Bus/TT	86	Sullivan Sq Sta to Reservoir (Cleveland Cir)	Yes	No	12:30	Outbound	142.50%	101.79%
Bus/TT	87	Arlington Ctr or Clarendon Hill to Lechmere Sta	Yes	No	17:35	Outbound	72.50%	51.79%
Bus/TT	88	Clarendon Hill to Lechmere Sta	Yes	Yes	18:50	Outbound	80.00%	57.14%
Bus/TT	89	Clarendon Hill to Sullivan Sq	Yes	No	17:00	Outbound	92.50%	66.07%
Bus/TT	91	Sullivan Sq Sta to Central Sq,Cambridge	Yes	Yes	11:05	Inbound	55.00%	39.29%
Bus/TT	93	Sullivan Sq Sta to Downtown via Bunker Hill St	No	No	17:20	Outbound	100.00%	71.43%
Bus/TT	94	Medford Sq to Davis Sq Sta	No	No	12:15	Inbound	67.50%	48.21%
Bus/TT	95	W Medford to Sullivan Sq Sta	No	No	17:30	Outbound	92.50%	66.07%
Bus/TT	96	Medford Squ to Harvard Sta	No	No	16:50	Outbound	70.00%	50.00%
Bus/TT	99	Boston Regional Med Ctr to Wellington Sta	No	No	15:00	Outbound	35.00%	25.00%
Bus/TT	100	Elm St to Wellington Sta	No	No	16:50	Inbound	30.00%	21.43%

Table A-2A (Expanded)
Average Vehicle Loading During Peak 30 Minutes (Typical Sunday)

Mode	Route	Route Name	Minority	Low Income	Time	Direction	Load Factor	Crowd Factor
Bus/TT	101	Malden Center Sta - Sullivan Sq Sta	No	No	18:30	Outbound	107.50%	76.79%
Bus/TT	104	Malden Ctr Sta to Sullivan Sq Sta	Yes	No	18:15	Outbound	85.00%	60.71%
Bus/TT	105	Malden Ctr Sta to Sullivan Sq Sta	Yes	No	9:45	Outbound	40.00%	28.57%
Bus/TT	106	Lebanon St, Malden to Wellington Sta	Yes	No	17:30	Outbound	65.00%	46.43%
Bus/TT	108	Linden Sq to Wellington Sta	No	No	17:40	Outbound	45.00%	32.14%
Bus/TT	109	Linden Sq to Sullivan Sq Sta	No	No	13:45	Outbound	125.00%	89.29%
Bus/TT	110	Wonderland or Park Ave. & Broadway to Wellington Sta	No	No	13:45	Inbound	55.00%	39.29%
Bus/TT	111	Woodlawn to Haymarket Sta	Yes	Yes	6:30	Inbound	167.50%	119.64%
Bus/TT	112	Wellington Sta to Wood Island Sta	Yes	Yes	16:00	Outbound	100.00%	71.43%
Bus/TT	116	Wonderland Sta to Maverick Sta	Yes	Yes	14:45-15:15	Outbound	197.50%	141.07%
Bus/TT	117	Wonderland Sta to Maverick Sta	Yes	Yes	16:15-16:45	Outbound	155.00%	110.71%
Bus/TT	119	Northgate to Beachmont Sta	No	No	15:00	Inbound	90.00%	64.29%
Bus/TT	120	Orient Heights to Maverick Sta	Yes	Yes	14:45	Outbound	87.50%	62.50%
Bus/TT	134	N Woburn to Wellington Sta	No	No	14:05	Outbound	40.00%	28.57%
Bus/TT	215	Quincy Ctr Sta to Ashmont Sta	No	No	17:05	Inbound	75.00%	53.57%
Bus/TT	216	Quincy Ctr Sta to Houghs Neck	No	No	9:45	Outbound	90.00%	64.29%
Bus/TT	220	Quincy Ctr Sta to Hingham or Fort Point	No	No	13:25	Outbound	60.00%	42.86%
Bus/TT	222	Quincy Ctr Sta to E Weymouth	No	No	17:30	Inbound	72.50%	51.79%
Bus/TT	225	Quincy Ctr Sta to Weymouth Landing	No	No	12:42	Outbound	72.50%	51.79%
Bus/TT	230	Quincy Ctr Sta to Brockton Line	No	No	22:05	Inbound	40.00%	28.57%
Bus/TT	236	Quincy Ctr Sta to S Shore Plaza	No	No	19:35	Outbound	82.50%	58.93%
Bus/TT	238	Quincy Ctr Sta to Holbrook/Randolph Commuter Rail Sta	No	No	17:05	Outbound	115.00%	82.14%
Bus/TT	240	Avon Line or Holbrook/Randolph Comm Rail Sta to Ashmont	No	No	18:06	Inbound	87.50%	62.50%
Bus/TT	350	N Burlington to Alewife Sta	No	No	18:00	Inbound	67.50%	48.21%
Bus/TT	426	Central Sq,Lynn & E Saugus to Haymarket Sta	No	No	12:45	Outbound	77.50%	55.36%
Bus/TT	429	Central Sq, Lynn to Linden Sq	No	No	9:45-10:15	Inbound	60.00%	42.86%
Bus/TT	435	Lynn to Danvers via North Shore & Liberty Tree Malls	No	No	13:15	Inbound	122.50%	87.50%
Bus/TT	436	Goodwin Cir to Central Sq, Lynn	No	No	10:10-10:30	Inbound	52.50%	37.50%

Table A-2A (Expanded)
Average Vehicle Loading During Peak 30 Minutes (Typical Sunday)

Mode	Route	Route Name	Minority	Low Income	Time	Direction	Load Factor	Crowd Factor
Bus/TT	441	Marblehead to Haymarket or Dtwn Xing via Paradise St	No	No	10:00	Inbound	130.00%	92.86%
Bus/TT	442	Marblehead to Haymarket via Humphrey St	No	No	8:00	Inbound	102.50%	73.21%
Bus/TT	450	Salem Depot to Haymarket Sta	No	Yes	19:15	Outbound	75.00%	53.57%
Bus/TT	455	Salem Depot to Haymarket via Loring Ave & Central Sq, Lynn	Yes	No	16:30	Outbound	110.00%	78.57%
Bus/TT	CT3	Beth Israel Deaconess to Logan Airport	Yes	Yes	12:40-13:09	Outbound	32.50%	23.21%
CR	Rockport	Rockport - North Station	No					
CR	Newburyport	Newburyport - North Station	Yes					
CR	Haverhill	Haverhill - North Station	No					
CR	Lowell	Lowell - North Station	No					
CR	Fitchburg	Fitchburg - North Station	No					
CR	Worcester	Worcester - South Station	No					
CR	Franklin	Franklin - South Station	No					
CR	Providence	Providence - South Station	Yes					
CR	Middleborough	Middleborough/Lakeville - South Station	No					
CR	Plymouth/Kingston	Plymouth/Kingston - South Station	No					
RT	Green - B	Boston College - Government Center	Yes					
RT	Green - C	Cleveland Circle - Government Center	Yes					
RT	Green - D	Riverside - Lechmere	No					
RT	Green - E	Heath Street - Lechmere	Yes					
RT	Green Central Sub	BC/Cleveland Circle/Riverside/Heath Street - Lechmere	Yes					
RT	Red - Mattapan	Mattapan - Ashmont	No					
RT	Red - Ashmont	Ashmont - Alewife	Yes					
RT	Red - Braintree	Braintree - Alewife	Yes					
RT	Red - Cambridge	Ashmont/Braintree - Alewife	Yes					
RT	Orange	Oak Grove - Forest Hills	Yes					
RT	Blue	Wonderland - Bowdoin	Yes					

Table A-3A (Expanded)
Vehicle Assignment (typical weekday)

Mode	District	Route	Route Name	Minority	Low Income	Avg. Age	% Air Cond
Bus/TT	Cabot	1	Harvard/Holyoke Gate to Dudley Sta	Yes	No	7.36	98.60%
Bus/TT	Cabot	3	City Pt. to Chinatown via Boston Marine Ind Pk	No	Yes	14.71	29.17%
Bus/TT	Cabot	4	N Sta to World Trade Ctr	Yes	No		
Bus/TT	Cabot	5	City Point to McCormack Housing	No	No	7.92	100.00%
Bus/TT	Cabot	6	Boston Marine Ind Park to Haymarket via S Sta	No	No	9.86	100.00%
Bus/TT	Cabot	7	City Point to Otis & Summer Sts	No	No	8.02	94.44%
Bus/TT	Cabot	8	Harbor Point/UMass to Kenmore Sta	Yes	Yes	10.51	63.00%
Bus/TT	Cabot	9	City Point to Copley Sq	No	No	7.95	94.37%
Bus/TT	Cabot	10	City Point to Copley Sq via Andrew Sta	Yes	Yes	8.73	86.46%
Bus/TT	Cabot	11	City Point (via Bayview) to Downtown	No	Yes	7.66	98.81%
Bus/TT	Arborway	14	Roslindale Sq to Dudley Sta	Yes	Yes	14.33	18.52%
Bus/TT	Cabot	15	Kane Sq or Fields Corner Sta to Ruggles Sta	Yes	Yes	7.54	98.42%
Bus/TT	Cabot	16	Forest Hills Sta to Andrew Sta or UMass	Yes	Yes	8.76	85.00%
Bus/TT	Cabot	17	Fields Corner Sta to Andrew Sta	Yes	Yes	11.65	49.00%
Bus/TT	Cabot	18	Ashmont Sta to Andrew Sta	Yes	Yes	12.58	97.22%
Bus/TT	Cabot	19	Fields Corner Sta to Ruggles Sta	Yes	Yes	9.04	80.39%
Bus/TT	Quincy	20	Fields Corner to Fields Corner via Neponset and Adams	Yes	No	14.21	59.80%
Bus/TT	Arborway	21	Ashmont Sta to Forest Hills Sta	Yes	No	11.62	48.67%
Bus/TT	Cabot	22	Ashmont Sta to Ruggles Sta	Yes	Yes	8.34	89.50%
Bus/TT	Cabot	23	Ashmont Sta to Ruggles Sta via Washington St	Yes	Yes	8.73	83.54%
Bus/TT	Arborway	24	Wakefield Ave.& Truman Pkwy to Mattapan or Ashmont Sta	Yes	No	9.13	76.39%
Bus/TT	Arborway	26	Ashmont Sta to Norfolk & Morton Belt Line	Yes	No	7.00	100.00%
Bus/TT	Arborway	27	Mattapan Sta to Ashmont Sta	Yes	No	10.07	65.91%
Bus/TT	Arborway	28	Mattapan Sta to Ruggles Sta	Yes	Yes	8.83	79.66%
Bus/TT	Arborway	29	Mattapan Sta to Jackson Sq, Sta	Yes	Yes	11.81	46.59%
Bus/TT	Arborway	30	Mattapan Sta to Roslindale Sq	Yes	No	10.38	62.50%
Bus/TT	Arborway	31	Mattapan Sta to Forest Hills Sta	Yes	No	9.80	68.93%
Bus/TT	Arborway	32	Wolcott Sq to Forest Hills Sta	Yes	Yes	9.87	68.08%
Bus/TT	Arborway	33	Dedham Line to Mattapan Sta	Yes	No	7.00	100.00%
Bus/TT	Arborway	34	Dedham Line to Forest Hills Sta	No	No	10.59	60.14%
Bus/TT	Arborway	34E	Walpole Ctr to Forest Hills Sta via Washington St	No	No	7.87	90.36%
Bus/TT	Arborway	35	Dedham Mall/Stimson St. to Forest Hills Sta	No	No	12.49	39.02%
Bus/TT	Arborway	36	Charles River Loop or V.A. Hosp to Forest Hills Sta	No	No	8.85	79.41%
Bus/TT	Arborway	37	Baker & Vt Sts to Forest Hills Sta	No	No	12.47	39.24%
Bus/TT	Arborway	38	Wren St to Forest Hills Sta	Yes	No	10.31	63.24%
Bus/TT	Arborway	39	Forest Hills Sta to Back Bay Sta	Yes	Yes	8.86	79.28%
Bus/TT	Arborway	40	Georgetowne to Forest Hills Sta	No	No	12.32	40.91%
Bus/TT	Arborway	41	Centre & Eliot Sts to Dudley Sta	Yes	Yes	10.59	83.91%
Bus/TT	Arborway	42	Forest Hills Sta to Ruggles Sta	Yes	Yes	9.57	71.43%
Bus/TT	Cabot	43	Ruggles Sta to Park & Tremont Sts	Yes	Yes	7.21	100.00%
Bus/TT	Cabot	44	Jackson Sq Sta to Ruggles Sta	Yes	Yes	8.09	90.51%
Bus/TT	Cabot	45	Franklin Park Zoo to Ruggles Sta	Yes	Yes	9.71	76.00%
Bus/TT	Arborway	46	Heath St & S Huntington Ave to Dudley Sta	Yes	Yes	13.53	27.45%
Bus/TT	Cabot	47	Central Sq, Cambridge to Broadway Sta	Yes	Yes	9.92	100.00%
Bus/TT	Arborway	48	Centre & Eliot Sts to Jamaica Plain Loop	Yes	No	13.00	100.00%
Bus/TT	Cabot	49	Dudley Sta to Downtown	Yes	Yes	7.91	92.34%
Bus/TT	Arborway	50	Cleary Sq to Forest Hills Sta	Yes	No	10.54	60.71%
Bus/TT	Arborway	51	Reservoir (Cleveland Cir) to Forest Hills Sta	No	No	10.09	65.63%

Table A-3A (Expanded)
Vehicle Assignment (typical weekday)

Mode	District	Route	Route Name	Minority	Low Income	Avg. Age	% Air Cond
Bus/TT	Arborway	52	Dedham Mall or Charles River Loop to Watertown Sq	No	No	8.15	87.23%
Bus/TT	Cabot	55	Jersey & Queensbury Sts to Copley Sq or Park	Yes	Yes	13.00	100.00%
Bus/TT	Cabot	57	Watertown Sq to Kenmore Sta	Yes	Yes	12.09	91.00%
Bus/TT	Cabot	59	Needham Junction to Watertown Sq	No	No	11.47	100.00%
Bus/TT	Cabot	60	Chesnut Hill to Kenmore Sta	Yes	No	10.66	100.00%
Bus/TT	Bennett	62	Bedford V.A. Hospital to Alewife Sta	No	No	7.30	100.00%
Bus/TT	Bennett	64	Oak Sq to University Pk or Kendall/MIT via Central Sq	Yes	No	9.82	83.00%
Bus/TT	Cabot	65	Brighton Ctr to Kenmore Sta	Yes	Yes	11.44	83.00%
Bus/TT	Cabot	66	Harvard Sq to Dudley Sta	Yes	No	8.62	86.00%
Bus/TT	Bennett	67	Turkey Hill to Alewife Sta	No	No	8.83	87.50%
Bus/TT	Bennett	68	Harvard Sq to Kendall/MIT via Broadway	Yes	No	7.42	100.00%
Bus/TT	Bennett	69	Harvard/Holyoke Gate to Lechmere Sta	Yes	No	8.56	90.00%
Bus/TT	Bennett	70	Cedarwood or Watertown Sq to University Pk	Yes	No	7.20	100.00%
Bus/TT	Bennett	70A	N Waltham to University Pk via Arsenal St & Western Ave	No	No	7.31	100.00%
Bus/TT	N Camb	71	Watertown Square to Harvard Station	No	No	26.00	0.00%
Bus/TT	N Camb	72	Huron Ave to Harvard Sta	Yes	No	26.00	0.00%
Bus/TT	N Camb	73	Waverly Sq to Harvard Sta	No	No	26.00	0.00%
Bus/TT	Bennett	74	Belmont Ctr to Harvard Sta	Yes	No	7.26	100.00%
Bus/TT	Bennett	75	Belmont Ctr to Harvard Sta	Yes	No	7.43	100.00%
Bus/TT	Bennett	76	Hanscom AFB to Alewife Sta via Mass Ave	No	No	7.31	100.00%
Bus/TT	Bennett	77	Arlington Heights to Harvard Sta	No	No	7.55	97.70%
Bus/TT	N Camb	77A	N Cambridge to Harvard Sta	Yes	No	26.00	0.00%
Bus/TT	Bennett	78	Arlmont Village to Harvard Sta	No	No	8.12	94.44%
Bus/TT	Bennett	79	Arlington Heights to Alewife Sta	No	No	8.75	98.88%
Bus/TT	Bennett	80	Arlington Ctr to Lechmere Sta	Yes	No	8.70	93.26%
Bus/TT	Bennett	83	Rindge Ave to Central Sq, Cambridge	Yes	Yes	8.32	89.32%
Bus/TT	Bennett	84	Arlmont Village to Alewife Sta	No	No	10.88	79.17%
Bus/TT	Bennett	85	Spring Hill to Kendall/MIT Sta	Yes	Yes	13.00	100.00%
Bus/TT	Bennett	86	Sullivan Sq Sta to Reservoir (Cleveland Cir)	Yes	No	8.20	94.00%
Bus/TT	Bennett	87	Arlington Ctr or Clarendon Hill to Lechmere Sta	Yes	No	8.25	93.40%
Bus/TT	Bennett	88	Clarendon Hill to Lechmere Sta	Yes	Yes	9.44	76.23%
Bus/TT	Salem St	89	Clarendon Hill to Sullivan Sq	Yes	No	7.80	97.64%
Bus/TT	Salem St	90	Davis Sq to Wellington Sta	Yes	Yes	8.19	93.02%
Bus/TT	Salem St	91	Sullivan Sq Sta to Central Sq,Cambridge	Yes	Yes	7.48	100.00%
Bus/TT	Salem St	92	Assembly Sq Mall to Downtown via Main St.	No	No	8.75	88.57%
Bus/TT	Salem St	93	Sullivan Sq Sta to Downtown via Bunker Hill St	No	No	9.60	79.33%
Bus/TT	Salem St	94	Medford Sq to Davis Sq Sta	No	No	14.30	30.00%
Bus/TT	Salem St	95	W Medford to Sullivan Sq Sta	No	No	14.78	37.86%
Bus/TT	Salem St	96	Medford Squ to Harvard Sta	No	No	14.64	28.21%
Bus/TT	Salem St	97	Malden Ctr Sta to Wellington Sta	No	No	13.36	75.76%
Bus/TT	Salem St	99	Boston Regional Med Ctr to Wellington Sta	No	No	14.38	44.44%
Bus/TT	Salem St	100	Elm St to Wellington Sta	No	No	13.86	61.22%
Bus/TT	Salem St	101	Malden Center Sta - Sullivan Sq Sta	No	No	12.73	51.75%
Bus/TT	Salem St	104	Malden Ctr Sta to Sullivan Sq Sta	Yes	No	7.78	94.90%
Bus/TT	Salem St	105	Malden Ctr Sta to Sullivan Sq Sta	Yes	No	13.98	75.61%
Bus/TT	Salem St	106	Lebanon St, Malden to Wellington Sta	Yes	No	14.12	47.67%
Bus/TT	Salem St	108	Linden Sq to Wellington Sta	No	No	12.98	75.28%
Bus/TT	Salem St	109	Linden Sq to Sullivan Sq Sta	No	No	7.58	100.00%

Table A-3A (Expanded)
Vehicle Assignment (typical weekday)

Mode	District	Route	Route Name	Minority	Low Income	Avg. Age	% Air Cond
Bus/TT	Salem St	110	Wonderland or Park Ave. & Broadway to Wellington Sta	No	No	8.60	86.41%
Bus/TT	Salem St	111	Woodlawn to Haymarket Sta	Yes	Yes	8.43	89.86%
Bus/TT	Salem St	112	Wellington Sta to Wood Island Sta	Yes	Yes	7.17	100.00%
Bus/TT	Lynn	114	Bellingham Sq to Maverick St	Yes	Yes	16.37	16.00%
Bus/TT	Lynn	116	Wonderland Sta to Maverick Sta	Yes	Yes	14.65	58.82%
Bus/TT	Lynn	117	Wonderland Sta to Maverick Sta	Yes	Yes	14.51	62.35%
Bus/TT	Lynn	119	Northgate to Beachmont Sta	No	No	14.00	75.00%
Bus/TT	Lynn	120	Orient Heights to Maverick Sta	Yes	Yes	13.48	88.04%
Bus/TT	Lynn	121	Wood Island Sta to Maverick Sta	Yes	Yes	13.00	100.00%
Bus/TT	Salem St	130	Lebanon St, Melrose to Malden Ctr Sta	No	No	16.14	21.43%
Bus/TT	Salem St	131	Melrose Highlands to Malden Ctr Sta	No	No	17.00	0.00%
Bus/TT	Salem St	132	Redstone Shopping Ctr to Malden Ctr Sta	No	No	16.17	20.69%
Bus/TT	Salem St	134	N Woburn to Wellington Sta	No	No	13.96	55.13%
Bus/TT	Salem St	136	Reading Depot to Malden Sta	No	No	14.93	51.72%
Bus/TT	Salem St	137	Reading Depot to Malden Sta	No	No	14.03	57.14%
Bus/TT	Cabot	170	Dudley Sta to Oak Park	Yes	Yes	13.00	100.00%
Bus/TT	Quincy	210	Quincy Ctr Sta to N Quincy or Fields Corner	No	No	15.06	35.29%
Bus/TT	Quincy	211	Quincy Ctr Sta to Squantum via Montclair	No	No	14.80	46.67%
Bus/TT	Quincy	212	Quincy Ctr Sta to N Quincy Sta	No	No	14.27	63.64%
Bus/TT	Quincy	214	Quincy Ctr Sta to Germantown	No	No	15.44	21.13%
Bus/TT	Quincy	215	Quincy Ctr Sta to Ashmont Sta	No	No	14.48	61.33%
Bus/TT	Quincy	216	Quincy Ctr Sta to Houghs Neck	No	No	14.91	40.78%
Bus/TT	Quincy	217	Wollaston Beach to Ashmont Sta via Beale St	No	No	14.43	52.38%
Bus/TT	Quincy	220	Quincy Ctr Sta to Hingham or Fort Point	No	No	14.07	73.33%
Bus/TT	Quincy	221	Quincy Ctr Sta to Hingham or Fort Point	No	No	14.40	60.00%
Bus/TT	Quincy	222	Quincy Ctr Sta to E Weymouth	No	No	14.48	54.55%
Bus/TT	Quincy	225	Quincy Ctr Sta to Weymouth Landing	No	No	15.23	34.21%
Bus/TT	Quincy	230	Quincy Ctr Sta to Brockton Line	No	No	14.65	53.33%
Bus/TT	Quincy	236	Quincy Ctr Sta to S Shore Plaza	No	No	14.42	64.52%
Bus/TT	Quincy	238	Quincy Ctr Sta to Holbrook/Randolph Commuter Rail Sta	No	No	14.21	68.97%
Bus/TT	Quincy	240	Avon Line or Holbrook/Randolph Comm Rail Sta to Ashmont	No	No	14.00	75.00%
Bus/TT	Quincy	245	Quincy Ctr Sta to Mattapan Sta via Pleasant St	No	No	14.06	64.71%
Bus/TT	Salem St	325	Medford to Haymarket	No	No	16.40	15.09%
Bus/TT	Salem St	326	W Medford to Haymarket Sta	No	No	16.51	12.24%
Bus/TT	Bennett	350	N Burlington to Alewife Sta	No	No	7.18	100.00%
Bus/TT	Bennett	351	Oak Park to Alewife Station Express	No	No	7.31	100.00%
Bus/TT	Salem St	352	Burlington to Boston via Rts 128 & 93	No	No	7.35	100.00%
Bus/TT	Salem St	354	Woburn Line to Boston via I-93	No	No	7.39	100.00%
Bus/TT	Salem St	355	Mishawum Sta to Boston	No	No	8.00	100.00%
Bus/TT	Salem St	411	Malden Center Station to Jack Satter House	No	No	15.50	38.00%
Bus/TT	Lynn	425	Central Sq, Lynn to Wonderland via Linden Sq	No	No		
Bus/TT	Lynn	426	Central Sq,Lynn & E Saugus to Haymarket Sta	No	No	14.74	56.41%
Bus/TT	Lynn	427	Granada Highlands to Haymarket via Linden Sq	No	No		
Bus/TT	Lynn	428	Oaklandvale to Haymarket via Cliftondale Sq	No	No		
Bus/TT	Lynn	429	Central Sq, Lynn to Linden Sq	No	No	13.82	79.59%
Bus/TT	Salem St	430	Saugus Ironworks to Malden Center Sta	No	No	14.80	34.15%
Bus/TT	Lynn	433	Pine Hill to Central Sq, Lynn	Yes	Yes	13.57	85.71%
Bus/TT	Lynn	435	Lynn to Danvers via North Shore & Liberty Tree Malls	No	No	13.00	100.00%

Table A-3A (Expanded)
Vehicle Assignment (typical weekday)

Mode	District	Route	Route Name	Minority	Low Income	Avg. Age	% Air Cond
Bus/TT	Lynn	436	Goodwin Cir to Central Sq, Lynn	No	No	14.66	58.54%
Bus/TT	Lynn	437	Lake Shore Park to Central Sq, Lynn	No	No	14.90	52.50%
Bus/TT	Lynn	439	Central Sq, Lynn to Bass Point, Nahant	No	No	16.41	14.81%
Bus/TT	Lynn	441	Marblehead to Haymarket or Dtwn Xing via Paradise St	No	No	14.67	58.33%
Bus/TT	Lynn	442	Marblehead to Haymarket via Humphrey St	No	No	14.70	57.38%
Bus/TT	Lynn	448	Marblehead to Dntn Xing via Paradise Rd	No	No		
Bus/TT	Lynn	449	Marblehead to Downtown Xing via Humphrey St	No	No		
Bus/TT	Lynn	450	Salem Depot to Haymarket Sta	No	Yes	14.38	65.52%
Bus/TT	Lynn	451	N Beverly to Salem Depot	No	No	15.55	36.36%
Bus/TT	Lynn	455	Salem Depot to Haymarket via Loring Ave & Central Sq, Lynn	Yes	No	13.20	95.12%
Bus/TT	Lynn	458	Salem Depot to Danvers Sq via Liberty Tree Mall	No	No	15.33	42.00%
Bus/TT	Lynn	459	Salem Depot to Dntn Xing via Humphrey St,	Yes	No	13.17	95.65%
Bus/TT	Lynn	468	Salem Depot to Danvers Sq	No	No	13.80	80.00%
Bus/TT	Cabot	500	Riverside to Downtown Boston	No	No	12.73	80.77%
Bus/TT	Cabot	501	Brighton Ctr to Downtown Boston	Yes	No	13.23	68.27%
Bus/TT	Cabot	502	Watertown Sq to Copley Sq	No	No	13.09	61.19%
Bus/TT	Cabot	504	Watertown Sq to Downtown Boston	No	No	13.27	74.55%
Bus/TT	Cabot	505	Central Sq, Waltham to Dntn Boston	No	No	13.13	87.14%
Bus/TT	Cabot	553	Roberts to Dntn Boston via Newton Corner & Mass Pike	No	No	11.40	86.67%
Bus/TT	Cabot	554	Waverley Sq to Downtown Boston	No	No	12.43	78.57%
Bus/TT	Cabot	556	Waltham Hlds. to Downtown Boston via Mass Pike	No	No	12.81	100.00%
Bus/TT	Cabot	558	Auburndale to Downtown Boston via Newton Cnr & Mass Pike	No	No	13.75	55.00%
Bus/TT	Cabot	CT1	Central Sq, Cambridge to BU Medical Ctr	Yes	No	7.00	100.00%
Bus/TT	Cabot	CT2	Kendall/MIT Station to Ruggles Sta	Yes	Yes	7.00	100.00%
Bus/TT	Cabot	CT3	Beth Israel Deaconess to Logan Airport	Yes	Yes	7.00	100.00%
CR	North	Rockport	Rockport - North Station	No		13.80	100.00%
CR	North	Newburyport	Newburyport - North Station	Yes		11.90	100.00%
CR	North	Haverhill	Haverhill - North Station	No		13.78	100.00%
CR	North	Lowell	Lowell - North Station	No		13.68	100.00%
CR	North	Fitchburg	Fitchburg - North Station	No		13.61	100.00%
CR	South	Worcester	Worcester - South Station	No		11.57	100.00%
CR	South	Needham	Needham - South Station	Yes		12.24	100.00%
CR	South	Franklin	Franklin - South Station	No		11.81	100.00%
CR	South	Providence	Providence - South Station	Yes		11.50	100.00%
CR	South	Stoughton	Stoughton - South Station	Yes		11.70	100.00%
CR	South	Fairmount	Readville - South Station	Yes		12.16	100.00%
CR	South	Middleborough	Middleborough/Lakeville - South Station	No		7.75	100.00%
CR	South	Plymouth/Kingston	Plymouth/Kingston - South Station	No		7.19	100.00%
RT	Light Rail	Green - B	Boston College - Government Center	Yes			100.00%
RT	Light Rail	Green - C	Cleveland Circle - Government Center	Yes			100.00%
RT	Light Rail	Green - D	Riverside - Lechmere	No			100.00%
RT	Light Rail	Green - E	Heath Street - Lechmere	Yes			100.00%
RT	Light Rail	Red - Mattapan	Mattapan - Ashmont	No		57.00	0.00%
RT	Heavy Rail	Red - Ashmont	Ashmont - Alewife	Yes		14.50	100.00%
RT	Heavy Rail	Red - Braintree	Braintree - Alewife	Yes		17.80	100.00%
RT	Heavy Rail	Orange	Oak Grove - Forest Hills	Yes		21.00	100.00%
RT	Heavy Rail	Blue	Wonderland - Bowdoin	Yes		23.00	100.00%

Table A-4A (Expanded)
Schedule Adherence (Typical Weekday)

Mode	Route	Route Name	Minority	Low Income	% On Time
Bus/TT	1	Harvard/Holyoke Gate to Dudley Sta	Yes	No	54.42%
Bus/TT	3	City Pt. to Chinatown via Boston Marine Ind Pk	No	Yes	31.58%
Bus/TT	4	N Sta to World Trade Ctr	Yes	No	30.77%
Bus/TT	5	City Point to McCormack Housing	No	No	41.67%
Bus/TT	6	Boston Marine Ind Park to Haymarket via S Sta	No	No	57.14%
Bus/TT	7	City Point to Otis & Summer Sts	No	No	58.33%
Bus/TT	8	Harbor Point/UMass to Kenmore Sta	Yes	Yes	55.63%
Bus/TT	9	City Point to Copley Sq	No	No	68.39%
Bus/TT	10	City Point to Copley Sq via Andrew Sta	Yes	Yes	38.54%
Bus/TT	11	City Point (via Bayview) to Downtown	No	Yes	67.26%
Bus/TT	14	Roslindale Sq to Dudley Sta	Yes	Yes	64.29%
Bus/TT	15	Kane Sq or Fields Corner Sta to Ruggles Sta	Yes	Yes	67.19%
Bus/TT	16	Forest Hills Sta to Andrew Sta or UMass	Yes	Yes	56.52%
Bus/TT	17	Fields Corner Sta to Andrew Sta	Yes	Yes	56.73%
Bus/TT	18	Ashmont Sta to Andrew Sta	Yes	Yes	50.00%
Bus/TT	19	Fields Corner Sta to Ruggles Sta	Yes	Yes	58.82%
Bus/TT	20	Fields Corner to Fields Corner via Neponset and Adams	Yes	No	86.41%
Bus/TT	21	Ashmont Sta to Forest Hills Sta	Yes	No	64.91%
Bus/TT	22	Ashmont Sta to Ruggles Sta	Yes	Yes	74.00%
Bus/TT	23	Ashmont Sta to Ruggles Sta via Washington St	Yes	Yes	62.61%
Bus/TT	24	Wakefield Ave.& Truman Pkwy to Mattapan or Ashmont Sta	Yes	No	80.56%
Bus/TT	26	Ashmont Sta to Norfolk & Morton Belt Line	Yes	No	56.03%
Bus/TT	27	Mattapan Sta to Ashmont Sta	Yes	No	84.09%
Bus/TT	28	Mattapan Sta to Ruggles Sta	Yes	Yes	63.98%
Bus/TT	29	Mattapan Sta to Jackson Sq, Sta	Yes	Yes	64.04%
Bus/TT	30	Mattapan Sta to Roslindale Sq	Yes	No	72.50%
Bus/TT	31	Mattapan Sta to Forest Hills Sta	Yes	No	80.58%
Bus/TT	32	Wolcott Sq to Forest Hills Sta	Yes	Yes	73.46%
Bus/TT	33	Dedham Line to Mattapan Sta	Yes	No	55.00%
Bus/TT	34	Dedham Line to Forest Hills Sta	No	No	57.21%
Bus/TT	34E	Walpole Ctr to Forest Hills Sta via Washington St	No	No	
Bus/TT	35	Dedham Mall/Stimson St. to Forest Hills Sta	No	No	71.95%
Bus/TT	36	Charles River Loop or V.A. Hosp to Forest Hills Sta	No	No	73.53%
Bus/TT	37	Baker & Vt Sts to Forest Hills Sta	No	No	81.01%
Bus/TT	38	Wren St to Forest Hills Sta	Yes	No	86.76%
Bus/TT	39	Forest Hills Sta to Back Bay Sta	Yes	Yes	60.77%
Bus/TT	40	Georgetowne to Forest Hills Sta	No	No	68.18%
Bus/TT	41	Centre & Eliot Sts to Dudley Sta	Yes	Yes	73.56%
Bus/TT	42	Forest Hills Sta to Ruggles Sta	Yes	Yes	72.27%
Bus/TT	43	Ruggles Sta to Park & Tremont Sts	Yes	Yes	68.54%
Bus/TT	44	Jackson Sq Sta to Ruggles Sta	Yes	Yes	66.42%

Table A-4A (Expanded)
Schedule Adherence (Typical Weekday)

Mode	Route	Route Name	Minority	Low Income	% On Time
Bus/TT	45	Franklin Park Zoo to Ruggles Sta	Yes	Yes	58.13%
Bus/TT	46	Heath St & S Huntington Ave to Dudley Sta	Yes	Yes	60.78%
Bus/TT	47	Central Sq, Cambridge to Broadway Sta	Yes	Yes	39.45%
Bus/TT	48	Centre & Eliot Sts to Jamaica Plain Loop	Yes	No	42.86%
Bus/TT	49	Dudley Sta to Downtown	Yes	Yes	71.65%
Bus/TT	50	Cleary Sq to Forest Hills Sta	Yes	No	71.43%
Bus/TT	51	Reservoir (Cleveland Cir) to Forest Hills Sta	No	No	68.75%
Bus/TT	52	Dedham Mall or Charles River Loop to Watertown Sq	No	No	48.94%
Bus/TT	55	Jersey & Queensbury Sts to Copley Sq or Park	Yes	Yes	59.21%
Bus/TT	57	Watertown Sq to Kenmore Sta	Yes	Yes	61.57%
Bus/TT	59	Needham Junction to Watertown Sq	No	No	51.56%
Bus/TT	60	Chesnut Hill to Kenmore Sta	Yes	No	52.63%
Bus/TT	62	Bedford V.A. Hospital to Alewife Sta	No	No	22.73%
Bus/TT	64	Oak Sq to University Pk or Kendall/MIT via Central Sq	Yes	No	50.65%
Bus/TT	65	Brighton Ctr to Kenmore Sta	Yes	Yes	36.51%
Bus/TT	66	Harvard Sq to Dudley Sta	Yes	No	55.74%
Bus/TT	67	Turkey Hill to Alewife Sta	No	No	70.83%
Bus/TT	68	Harvard Sq to Kendall/MIT via Broadway	Yes	No	97.92%
Bus/TT	69	Harvard/Holyoke Gate to Lechmere Sta	Yes	No	78.07%
Bus/TT	70	Cedarwood or Watertown Sq to University Pk	Yes	No	43.64%
Bus/TT	70A	N Waltham to University Pk via Arsenal St & Western Ave	No	No	50.00%
Bus/TT	71	Watertown Square to Harvard Station	No	No	58.38%
Bus/TT	72	Huron Ave to Harvard Sta	Yes	No	79.84%
Bus/TT	73	Waverly Sq to Harvard Sta	No	No	58.50%
Bus/TT	74	Belmont Ctr to Harvard Sta	Yes	No	54.17%
Bus/TT	75	Belmont Ctr to Harvard Sta	Yes	No	43.48%
Bus/TT	76	Hanscom AFB to Alewife Sta via Mass Ave	No	No	53.33%
Bus/TT	77	Arlington Heights to Harvard Sta	No	No	65.04%
Bus/TT	77A	N Cambridge to Harvard Sta	Yes	No	
Bus/TT	78	Arlmont Village to Harvard Sta	No	No	42.22%
Bus/TT	79	Arlington Heights to Alewife Sta	No	No	60.20%
Bus/TT	80	Arlington Ctr to Lechmere Sta	Yes	No	53.93%
Bus/TT	83	Rindge Ave to Central Sq, Cambridge	Yes	Yes	66.02%
Bus/TT	84	Arlmont Village to Alewife Sta	No	No	79.17%
Bus/TT	85	Spring Hill to Kendall/MIT Sta	Yes	Yes	85.00%
Bus/TT	86	Sullivan Sq Sta to Reservoir (Cleveland Cir)	Yes	No	48.00%
Bus/TT	87	Arlington Ctr or Clarendon Hill to Lechmere Sta	Yes	No	50.00%
Bus/TT	88	Clarendon Hill to Lechmere Sta	Yes	Yes	53.28%
Bus/TT	89	Clarendon Hill to Sullivan Sq	Yes	No	69.29%
Bus/TT	90	Davis Sq to Wellington Sta	Yes	Yes	55.81%
Bus/TT	91	Sullivan Sq Sta to Central Sq,Cambridge	Yes	Yes	60.00%

Table A-4A (Expanded)
Schedule Adherence (Typical Weekday)

Mode	Route	Route Name	Minority	Low Income	% On Time
Bus/TT	92	Assembly Sq Mall to Downtown via Main St.	No	No	54.29%
Bus/TT	93	Sullivan Sq Sta to Downtown via Bunker Hill St	No	No	62.57%
Bus/TT	94	Medford Sq to Davis Sq Sta	No	No	55.00%
Bus/TT	95	W Medford to Sullivan Sq Sta	No	No	45.63%
Bus/TT	96	Medford Squ to Harvard Sta	No	No	48.72%
Bus/TT	97	Malden Ctr Sta to Wellington Sta	No	No	81.82%
Bus/TT	99	Boston Regional Med Ctr to Wellington Sta	No	No	75.31%
Bus/TT	100	Elm St to Wellington Sta	No	No	74.49%
Bus/TT	101	Malden Center Sta - Sullivan Sq Sta	No	No	61.74%
Bus/TT	104	Malden Ctr Sta to Sullivan Sq Sta	Yes	No	61.22%
Bus/TT	105	Malden Ctr Sta to Sullivan Sq Sta	Yes	No	78.05%
Bus/TT	106	Lebanon St, Malden to Wellington Sta	Yes	No	49.25%
Bus/TT	108	Linden Sq to Wellington Sta	No	No	64.04%
Bus/TT	109	Linden Sq to Sullivan Sq Sta	No	No	67.29%
Bus/TT	110	Wonderland or Park Ave. & Broadway to Wellington Sta	No	No	64.08%
Bus/TT	111	Woodlawn to Haymarket Sta	Yes	Yes	68.95%
Bus/TT	112	Wellington Sta to Wood Island Sta	Yes	Yes	30.61%
Bus/TT	114	Bellingham Sq to Maverick St	Yes	Yes	78.95%
Bus/TT	116	Wonderland Sta to Maverick Sta	Yes	Yes	40.00%
Bus/TT	117	Wonderland Sta to Maverick Sta	Yes	Yes	51.16%
Bus/TT	119	Northgate to Beachmont Sta	No	No	58.00%
Bus/TT	120	Orient Heights to Maverick Sta	Yes	Yes	46.74%
Bus/TT	121	Wood Island Sta to Maverick Sta	Yes	Yes	81.48%
Bus/TT	130	Lebanon St, Melrose to Malden Ctr Sta	No	No	85.71%
Bus/TT	131	Melrose Highlands to Malden Ctr Sta	No	No	77.14%
Bus/TT	132	Redstone Shopping Ctr to Malden Ctr Sta	No	No	62.07%
Bus/TT	134	N Woburn to Wellington Sta	No	No	61.54%
Bus/TT	136	Reading Depot to Malden Sta	No	No	20.69%
Bus/TT	137	Reading Depot to Malden Sta	No	No	62.86%
Bus/TT	170	Dudley Sta to Oak Park	Yes	Yes	0.00%
Bus/TT	210	Quincy Ctr Sta to N Quincy or Fields Corner	No	No	50.98%
Bus/TT	211	Quincy Ctr Sta to Squantum via Montclair	No	No	73.33%
Bus/TT	212	Quincy Ctr Sta to N Quincy Sta	No	No	86.36%
Bus/TT	214	Quincy Ctr Sta to Germantown	No	No	71.83%
Bus/TT	215	Quincy Ctr Sta to Ashmont Sta	No	No	65.33%
Bus/TT	216	Quincy Ctr Sta to Houghs Neck	No	No	73.79%
Bus/TT	217	Wollaston Beach to Ashmont Sta via Beale St	No	No	71.43%
Bus/TT	220	Quincy Ctr Sta to Hingham or Fort Point	No	No	57.78%
Bus/TT	221	Quincy Ctr Sta to Hingham or Fort Point	No	No	90.00%
Bus/TT	222	Quincy Ctr Sta to E Weymouth	No	No	63.64%
Bus/TT	225	Quincy Ctr Sta to Weymouth Landing	No	No	76.32%

Table A-4A (Expanded)
Schedule Adherence (Typical Weekday)

Mode	Route	Route Name	Minority	Low Income	% On Time
Bus/TT	230	Quincy Ctr Sta to Brockton Line	No	No	53.33%
Bus/TT	236	Quincy Ctr Sta to S Shore Plaza	No	No	61.29%
Bus/TT	238	Quincy Ctr Sta to Holbrook/Randolph Commuter Rail Sta	No	No	39.66%
Bus/TT	240	Avon Line or Holbrook/Randolph Comm Rail Sta to Ashmont	No	No	51.09%
Bus/TT	245	Quincy Ctr Sta to Mattapan Sta via Pleasant St	No	No	50.00%
Bus/TT	325	Medford to Haymarket	No	No	77.36%
Bus/TT	326	W Medford to Haymarket Sta	No	No	47.92%
Bus/TT	350	N Burlington to Alewife Sta	No	No	54.55%
Bus/TT	351	Oak Park to Alewife Station Express	No	No	100.00%
Bus/TT	352	Burlington to Boston via Rts 128 & 93	No	No	95.65%
Bus/TT	354	Woburn Line to Boston via I-93	No	No	86.36%
Bus/TT	355	Mishawum Sta to Boston	No	No	100.00%
Bus/TT	411	Malden Center Station to Jack Satter House	No	No	33.33%
Bus/TT	425	Central Sq, Lynn to Wonderland via Linden Sq	No	No	50.00%
Bus/TT	426	Central Sq,Lynn & E Saugus to Haymarket Sta	No	No	73.68%
Bus/TT	427	Granada Highlands to Haymarket via Linden Sq	No	No	75.00%
Bus/TT	428	Oaklandvale to Haymarket via Cliftondale Sq	No	No	20.00%
Bus/TT	429	Central Sq, Lynn to Linden Sq	No	No	37.04%
Bus/TT	430	Saugus Ironworks to Malden Center Sta	No	No	34.15%
Bus/TT	433	Pine Hill to Central Sq, Lynn	Yes	Yes	85.71%
Bus/TT	435	Lynn to Danvers via North Shore & Liberty Tree Malls	No	No	54.55%
Bus/TT	436	Goodwin Cir to Central Sq, Lynn	No	No	42.11%
Bus/TT	437	Lake Shore Park to Central Sq, Lynn	No	No	60.00%
Bus/TT	439	Central Sq, Lynn to Bass Point, Nahant	No	No	40.74%
Bus/TT	441	Marblehead to Haymarket or Dtwn Xing via Paradise St	No	No	36.67%
Bus/TT	442	Marblehead to Haymarket via Humphrey St	No	No	59.52%
Bus/TT	448	Marblehead to Dntn Xing via Paradise Rd	No	No	40.00%
Bus/TT	449	Marblehead to Downtown Xing via Humphrey St	No	No	33.33%
Bus/TT	450	Salem Depot to Haymarket Sta	No	Yes	25.86%
Bus/TT	451	N Beverly to Salem Depot	No	No	77.27%
Bus/TT	455	Salem Depot to Haymarket via Loring Ave & Central Sq, Lynn	Yes	No	51.22%
Bus/TT	458	Salem Depot to Danvers Sq via Liberty Tree Mall	No	No	70.83%
Bus/TT	459	Salem Depot to Dntn Xing via Humphrey St,	Yes	No	39.13%
Bus/TT	468	Salem Depot to Danvers Sq	No	No	60.00%
Bus/TT	500	Riverside to Downtown Boston	No	No	63.46%
Bus/TT	501	Brighton Ctr to Downtown Boston	Yes	No	68.27%
Bus/TT	502	Watertown Sq to Copley Sq	No	No	85.07%
Bus/TT	504	Watertown Sq to Downtown Boston	No	No	84.55%
Bus/TT	505	Central Sq, Waltham to Dntn Boston	No	No	51.43%
Bus/TT	553	Roberts to Dntn Boston via Newton Corner & Mass Pike	No	No	43.33%
Bus/TT	554	Waverley Sq to Downtown Boston	No	No	50.00%

Table A-4A (Expanded)
Schedule Adherence (Typical Weekday)

Mode	Route	Route Name	Minority	Low Income	% On Time
Bus/TT	556	Waltham Hlds. to Downtown Boston via Mass Pike	No	No	61.29%
Bus/TT	558	Auburndale to Downtown Boston via Newton Cnr & Mass Pike	No	No	80.00%
Bus/TT	CT1	Central Sq, Cambridge to BU Medical Ctr	Yes	No	52.00%
Bus/TT	CT2	Kendall/MIT Station to Ruggles Sta	Yes	Yes	30.77%
Bus/TT	CT3	Beth Israel Deaconess to Andrew Station	Yes	Yes	54.67%
Bus/TT	CT3	Andrew Station to Logan Airport	Yes	Yes	41.89%
CR	Rockport	Rockport - North Station	No		
CR	Newburyport	Newburyport - North Station	Yes		
CR	Haverhill	Haverhill - North Station	No		
CR	Lowell	Lowell - North Station	No		
CR	Fitchburg	Fitchburg - North Station	No		
CR	Worcester	Worcester - South Station	No		
CR	Needham	Needham - South Station	Yes		
CR	Franklin	Franklin - South Station	No		
CR	Providence	Providence - South Station	Yes		
CR	Stoughton	Stoughton - South Station	Yes		
CR	Fairmount	Readville - South Station	Yes		
CR	Middleborough	Middleborough/Lakeville - South Station	No		
CR	Plymouth/Kingston	Plymouth/Kingston - South Station	No		
RT	Green - B	Boston College - Government Center	Yes		
RT	Green - C	Cleveland Circle - Government Center	Yes		
RT	Green - D	Riverside - Lechmere	No		
RT	Green - E	Heath Street - Lechmere	Yes		
RT	Green Central Sub.	BC/Cleveland Circle/Riverside/Heath Street - Lechmere	Yes		
RT	Red - Mattapan	Mattapan - Ashmont	No		
RT	Red - Ashmont	Ashmont - Alewife	Yes		
RT	Red - Braintree	Braintree - Alewife	Yes		
RT	Red - Cambridge	Ashmont/Braintree - Alewife	Yes		
RT	Orange	Oak Grove - Forest Hills	Yes		
RT	Blue	Wonderland - Bowdoin	Yes		

Table A-4A (Expanded)
Schedule Adherence (Typical Saturday)

Mode	Route	Route Name	Minority	Low Income	% On Time
Bus/TT	1	Harvard/Holyoke Gate to Dudley Sta	Yes	No	48.35%
Bus/TT	5	City Point to McCormack Housing	No	No	33.33%
Bus/TT	7	City Point to Otis & Summer Sts	No	No	77.14%
Bus/TT	8	Harbor Point/UMass to Kenmore Sta	Yes	Yes	41.86%
Bus/TT	9	City Point to Copley Sq	No	No	67.71%
Bus/TT	10	City Point to Copley Sq via Andrew Sta	Yes	Yes	58.90%
Bus/TT	11	City Point (via Bayview) to Downtown	No	Yes	40.19%
Bus/TT	14	Roslindale Sq to Dudley Sta	Yes	Yes	61.90%
Bus/TT	15	Kane Sq or Fields Corner Sta to Ruggles Sta	Yes	Yes	56.45%
Bus/TT	16	Forest Hills Sta to Andrew Sta or UMass	Yes	Yes	68.18%
Bus/TT	17	Fields Corner Sta to Andrew Sta	Yes	Yes	82.02%
Bus/TT	18	Ashmont Sta to Andrew Sta	Yes	Yes	55.00%
Bus/TT	20	Fields Corner Sta to Fields Corner Sta	Yes	No	61.54%
Bus/TT	21	Ashmont Sta to Forest Hills Sta	Yes	No	83.33%
Bus/TT	22	Ashmont Sta to Ruggles Sta	Yes	Yes	58.55%
Bus/TT	23	Ashmont Sta to Ruggles Sta via Washington St	Yes	Yes	56.10%
Bus/TT	24	Wakefield Ave.& Truman Pkwy to Mattapan or Ashmont Sta	Yes	No	51.06%
Bus/TT	26	Ashmont Sta to Norfolk & Morton Belt Line	Yes	No	51.22%
Bus/TT	27	Mattapan Sta to Ashmont Sta	Yes	No	73.58%
Bus/TT	28	Mattapan Sta to Ruggles Sta	Yes	Yes	69.54%
Bus/TT	29	Mattapan Sta to Jackson Sq, Sta	Yes	Yes	76.67%
Bus/TT	30	Mattapan Sta to Roslindale Sq	Yes	No	71.70%
Bus/TT	31	Mattapan Sta to Forest Hills Sta	Yes	No	74.07%
Bus/TT	32	Wolcott Sq to Forest Hills Sta	Yes	Yes	78.85%
Bus/TT	33	Dedham Line to Mattapan Sta	Yes	No	30.77%
Bus/TT	34	Dedham Line to Forest Hills Sta	No	No	43.38%
Bus/TT	34E	Walpole Ctr to Forest Hills Sta via Washington St	No	No	
Bus/TT	35	Dedham Mall/Stimson St. to Forest Hills Sta	No	No	68.33%
Bus/TT	36	Charles River Loop or V.A. Hosp to Forest Hills Sta	No	No	63.22%
Bus/TT	37	Baker & Vt Sts to Forest Hills Sta	No	No	39.66%
Bus/TT	38	Wren St to Forest Hills Sta	Yes	No	86.96%
Bus/TT	39	Forest Hills Sta to Back Bay Sta	Yes	Yes	59.56%
Bus/TT	40	Georgetowne to Forest Hills Sta	No	No	50.00%
Bus/TT	41	Centre & Eliot Sts to Dudley Sta	Yes	Yes	57.14%
Bus/TT	42	Forest Hills Sta to Ruggles Sta	Yes	Yes	71.59%
Bus/TT	43	Ruggles Sta to Park & Tremont Sts	Yes	Yes	65.57%
Bus/TT	44	Jackson Sq Sta to Ruggles Sta	Yes	Yes	67.31%
Bus/TT	45	Franklin Park Zoo to Ruggles Sta	Yes	Yes	70.94%
Bus/TT	46	Heath St & S Huntington Ave to Dudley Sta	Yes	Yes	98.04%
Bus/TT	47	Central Sq, Cambridge to Broadway Sta	Yes	Yes	56.25%
Bus/TT	48	Centre & Eliot Sts to Jamaica Plain Loop	Yes	No	25.00%

Table A-4A (Expanded)
Schedule Adherence (Typical Saturday)

Mode	Route	Route Name	Minority	Low Income	% On Time
Bus/TT	49	Dudley Sta to Downtown	Yes	Yes	51.03%
Bus/TT	50	Cleary Sq to Forest Hills Sta	Yes	No	84.62%
Bus/TT	51	Reservoir (Cleveland Cir) to Forest Hills Sta	No	No	50.00%
Bus/TT	52	Dedham Mall or Charles River Loop to Watertown Sq	No	No	41.38%
Bus/TT	55	Jersey & Queensbury Sts to Copley Sq or Park	Yes	Yes	71.79%
Bus/TT	57	Watertown Sq to Kenmore Sta	Yes	Yes	64.22%
Bus/TT	59	Needham Junction to Watertown Sq	No	No	26.47%
Bus/TT	60	Chesnut Hill to Kenmore Sta	Yes	No	15.38%
Bus/TT	62	Bedford V.A. Hospital to Alewife Sta	No	No	28.57%
Bus/TT	64	Oak Sq to University Pk or Kendall/MIT via Central Sq	Yes	No	68.29%
Bus/TT	65	Brighton Ctr to Kenmore Sta	Yes	Yes	67.39%
Bus/TT	66	Harvard Sq to Dudley Sta	Yes	No	40.60%
Bus/TT	69	Harvard/Holyoke Gate to Lechmere Sta	Yes	No	0.00%
Bus/TT	70	Cedarwood or Watertown Sq to University Pk	Yes	No	52.14%
Bus/TT	70A	N Waltham to University Pk via Arsenal St & Western Ave	No	No	51.61%
Bus/TT	71	Watertown Square to Harvard Station	No	No	52.26%
Bus/TT	72	Huron Ave to Harvard Sta	Yes	No	64.77%
Bus/TT	73	Waverly Sq to Harvard Sta	No	No	45.45%
Bus/TT	74	Belmont Ctr to Harvard Sta	Yes	No	62.86%
Bus/TT	75	Belmont Ctr to Harvard Sta	Yes	No	66.67%
Bus/TT	76	Hanscom AFB to Alewife Sta via Mass Ave	No	No	41.67%
Bus/TT	77	Arlington Heights to Harvard Sta	No	No	60.71%
Bus/TT	78	Arlmont Village to Harvard Sta	No	No	62.16%
Bus/TT	80	Arlington Ctr to Lechmere Sta	Yes	No	73.77%
Bus/TT	83	Rindge Ave to Central Sq, Cambridge	Yes	Yes	64.38%
Bus/TT	86	Sullivan Sq Sta to Reservoir (Cleveland Cir)	Yes	No	40.38%
Bus/TT	87	Arlington Ctr or Clarendon Hill to Lechmere Sta	Yes	No	75.00%
Bus/TT	88	Clarendon Hill to Lechmere Sta	Yes	Yes	68.97%
Bus/TT	89	Clarendon Hill to Sullivan Sq	Yes	No	69.57%
Bus/TT	90	Davis Sq to Wellington Sta	Yes	Yes	70.00%
Bus/TT	91	Sullivan Sq Sta to Central Sq,Cambridge	Yes	Yes	85.06%
Bus/TT	92	Assembly Sq Mall to Downtown via Main St.	No	No	34.48%
Bus/TT	93	Sullivan Sq Sta to Downtown via Bunker Hill St	No	No	40.21%
Bus/TT	94	Medford Sq to Davis Sq Sta	No	No	62.26%
Bus/TT	95	W Medford to Sullivan Sq Sta	No	No	51.61%
Bus/TT	96	Medford Squ to Harvard Sta	No	No	60.00%
Bus/TT	97	Malden Ctr Sta to Wellington Sta	No	No	68.18%
Bus/TT	99	Boston Regional Med Ctr to Wellington Sta	No	No	35.48%
Bus/TT	100	Elm St to Wellington Sta	No	No	57.97%
Bus/TT	101	Malden Center Sta - Sullivan Sq Sta	No	No	54.29%
Bus/TT	104	Malden Ctr Sta to Sullivan Sq Sta	Yes	No	53.33%

Table A-4A (Expanded)
Schedule Adherence (Typical Saturday)

Mode	Route	Route Name	Minority	Low Income	% On Time
Bus/TT	105	Malden Ctr Sta to Sullivan Sq Sta	Yes	No	76.92%
Bus/TT	106	Lebanon St, Malden to Wellington Sta	Yes	No	65.67%
Bus/TT	108	Linden Sq to Wellington Sta	No	No	68.66%
Bus/TT	109	Linden Sq to Sullivan Sq Sta	No	No	49.18%
Bus/TT	110	Wonderland or Park Ave. & Broadway to Wellington Sta	No	No	40.85%
Bus/TT	111	Woodlawn to Haymarket Sta	Yes	Yes	78.46%
Bus/TT	112	Wellington Sta to Wood Island Sta	Yes	Yes	53.85%
Bus/TT	116	Wonderland Sta to Maverick Sta	Yes	Yes	49.18%
Bus/TT	117	Wonderland Sta to Maverick Sta	Yes	Yes	51.61%
Bus/TT	119	Northgate to Beachmont Sta	No	No	65.38%
Bus/TT	120	Orient Heights to Maverick Sta	Yes	Yes	70.31%
Bus/TT	130	Lebanon St, Melrose to Malden Ctr Sta	No	No	100.00%
Bus/TT	132	Redstone Shopping Ctr to Malden Ctr Sta	No	No	37.50%
Bus/TT	134	N Woburn to Wellington Sta	No	No	35.38%
Bus/TT	136	Reading Depot to Malden Sta	No	No	66.67%
Bus/TT	137	Reading Depot to Malden Sta	No	No	54.17%
Bus/TT	210	Quincy Ctr Sta to N Quincy or Fields Corner	No	No	71.43%
Bus/TT	211	Quincy Ctr Sta to Squantum via Montclair	No	No	61.54%
Bus/TT	212	Quincy Ctr Sta to N Quincy Sta	No	No	72.22%
Bus/TT	214	Quincy Ctr Sta to Germantown	No	No	86.36%
Bus/TT	215	Quincy Ctr Sta to Ashmont Sta	No	No	62.30%
Bus/TT	216	Quincy Ctr Sta to Houghs Neck	No	No	72.62%
Bus/TT	217/245	Wollaston Beach to Mattapan Sta via Beale St	No	No	58.33%
Bus/TT	220	Quincy Ctr Sta to Hingham or Fort Point	No	No	73.33%
Bus/TT	222	Quincy Ctr Sta to E Weymouth	No	No	56.25%
Bus/TT	225	Quincy Ctr Sta to Weymouth Landing	No	No	75.86%
Bus/TT	230	Quincy Ctr Sta to Brockton Line	No	No	58.33%
Bus/TT	236	Quincy Ctr Sta to S Shore Plaza	No	No	54.17%
Bus/TT	238	Quincy Ctr Sta to Holbrook/Randolph Commuter Rail Sta	No	No	41.30%
Bus/TT	240	Avon Line or Holbrook/Randolph Comm Rail Sta to Ashmont	No	No	65.08%
Bus/TT	245	Quincy Ctr Sta to Mattapan Sta via Pleasant St	No	No	41.67%
Bus/TT	350	N Burlington to Alewife Sta	No	No	55.56%
Bus/TT	411	Malden Center Station to Jack Satter House	No	No	50.00%
Bus/TT	426	Central Sq,Lynn & E Saugus to Haymarket Sta	No	No	64.71%
Bus/TT	429	Central Sq, Lynn to Linden Sq	No	No	33.33%
Bus/TT	430	Saugus Ironworks to Malden Center Sta	No	No	55.56%
Bus/TT	435	Lynn to Danvers via North Shore & Liberty Tree Malls	No	No	75.00%
Bus/TT	436	Goodwin Cir to Central Sq, Lynn	No	No	18.18%
Bus/TT	441	Marblehead to Haymarket or Dtwn Xing via Paradise St	No	No	37.50%
Bus/TT	442	Marblehead to Haymarket via Humphrey St	No	No	26.67%
Bus/TT	450	Salem Depot to Haymarket Sta	No	Yes	11.11%

Table A-4A (Expanded)
Schedule Adherence (Typical Saturday)

Mode	Route	Route Name	Minority	Low Income	% On Time
Bus/TT	455	Salem Depot to Haymarket via Loring Ave & Central Sq, Lynn	Yes	No	59.65%
Bus/TT	504	Watertown Sq to Downtown Boston	No	No	64.29%
Bus/TT	553	Roberts to Dntn Boston via Newton Corner & Mass Pike	No	No	73.08%
Bus/TT	554	Waverley Sq to Downtown Boston	No	No	3.85%
Bus/TT	CT3	Andrew Station to Logan Airport	Yes	Yes	61.29%
CR	Rockport	Rockport - North Station	No		
CR	Newburyport	Newburyport - North Station	Yes		
CR	Haverhill	Haverhill - North Station	No		
CR	Lowell	Lowell - North Station	No		
CR	Fitchburg	Fitchburg - North Station	No		
CR	Worcester	Worcester - South Station	No		
CR	Needham	Needham - South Station	Yes		
CR	Franklin	Franklin - South Station	No		
CR	Providence	Providence - South Station	Yes		
CR	Middleborough	Middleborough/Lakeville - South Station	No		
CR	Plymouth/Kingston	Plymouth/Kingston - South Station	No		
RT	Green - B	Boston College - Government Center	Yes		
RT	Green - C	Cleveland Circle - Government Center	Yes		
RT	Green - D	Riverside - Lechmere	No		
RT	Green - E	Heath Street - Lechmere	Yes		
RT	Green Central Sub.	BC/Cleveland Circle/Riverside/Heath Street - Lechmere	Yes		
RT	Red - Mattapan	Mattapan - Ashmont	No		
RT	Red - Ashmont	Ashmont - Alewife	Yes		
RT	Red - Braintree	Braintree - Alewife	Yes		
RT	Red - Cambridge	Ashmont/Braintree - Alewife	Yes		
RT	Orange	Oak Grove - Forest Hills	Yes		
RT	Blue	Wonderland - Bowdoin	Yes		

Table A-4A (Expanded)
Schedule Adherence (Typical Sunday)

Mode	Route	Route Name	Minority	Low Income	% On Time
Bus/TT	1	Harvard/Holyoke Gate to Dudley Sta	Yes	No	58.73%
Bus/TT	8	Harbor Point/UMass to Kenmore Sta	Yes	Yes	78.26%
Bus/TT	9	City Point to Copley Sq	No	No	70.97%
Bus/TT	10	City Point to Copley Sq via Andrew Sta	Yes	Yes	70.21%
Bus/TT	11	City Point (via Bayview) to Downtown	No	Yes	60.00%
Bus/TT	15	Kane Sq or Fields Corner Sta to Ruggles Sta	Yes	Yes	60.87%
Bus/TT	16	Forest Hills Sta to Andrew Sta or UMass	Yes	Yes	68.00%
Bus/TT	17	Fields Corner Sta to Andrew Sta	Yes	Yes	96.88%
Bus/TT	18	Ashmont Sta to Andrew Sta	Yes	Yes	75.00%
Bus/TT	20	Fields Corner Sta to Fields Corner Sta	Yes	No	68.18%
Bus/TT	22	Ashmont Sta to Ruggles Sta	Yes	Yes	69.30%
Bus/TT	23	Ashmont Sta to Ruggles Sta via Washington St	Yes	Yes	64.35%
Bus/TT	24	Wakefield Ave.& Truman Pkwy to Mattapan or Ashmont Sta	Yes	No	84.62%
Bus/TT	26	Ashmont Sta to Norfolk & Morton Belt Line	Yes	No	57.69%
Bus/TT	27	Mattapan Sta to Ashmont Sta	Yes	No	70.83%
Bus/TT	28	Mattapan Sta to Ruggles Sta	Yes	Yes	56.13%
Bus/TT	30	Mattapan Sta to Roslindale Sq	Yes	No	87.50%
Bus/TT	31	Mattapan Sta to Forest Hills Sta	Yes	No	80.61%
Bus/TT	32	Wolcott Sq to Forest Hills Sta	Yes	Yes	73.61%
Bus/TT	34	Dedham Line to Forest Hills Sta	No	No	74.73%
Bus/TT	34E	Walpole Ctr to Forest Hills Sta via Washington St	No	No	
Bus/TT	35	Dedham Mall/Stimson St. to Forest Hills Sta	No	No	88.89%
Bus/TT	36	Charles River Loop or V.A. Hosp to Forest Hills Sta	No	No	76.71%
Bus/TT	37/38	Baker & Vt Sts to Forest Hills Sta	No	No	80.00%
Bus/TT	39	Forest Hills Sta to Back Bay Sta	Yes	Yes	66.95%
Bus/TT	42	Forest Hills Sta to Ruggles Sta	Yes	Yes	95.56%
Bus/TT	43	Ruggles Sta to Park & Tremont Sts	Yes	Yes	50.00%
Bus/TT	44	Jackson Sq Sta to Ruggles Sta	Yes	Yes	80.00%
Bus/TT	45	Franklin Park Zoo to Ruggles Sta	Yes	Yes	51.06%
Bus/TT	47	Central Sq, Cambridge to Broadway Sta	Yes	Yes	42.86%
Bus/TT	49	Dudley Sta to Downtown	Yes	Yes	45.65%
Bus/TT	55	Jersey & Queensbury Sts to Copley Sq or Park	Yes	Yes	82.35%
Bus/TT	57	Watertown Sq to Kenmore Sta	Yes	Yes	57.14%
Bus/TT	60	Chesnut Hill to Kenmore Sta	Yes	No	75.00%
Bus/TT	64	Oak Sq to University Pk or Kendall/MIT via Central Sq	Yes	No	70.00%
Bus/TT	66	Harvard Sq to Dudley Sta	Yes	No	50.79%
Bus/TT	69	Harvard/Holyoke Gate to Lechmere Sta	Yes	No	60.56%
Bus/TT	70	Cedarwood or Watertown Sq to University Pk	Yes	No	41.18%
Bus/TT	71	Watertown Square to Harvard Station	No	No	68.18%
Bus/TT	72/75	Belmont Ctr to Harvard Sta	Yes	No	77.08%
Bus/TT	73	Waverly Sq to Harvard Sta	No	No	60.00%

Table A-4A (Expanded)
Schedule Adherence (Typical Sunday)

Mode	Route	Route Name	Minority	Low Income	% On Time
Bus/TT	77	Arlington Heights to Harvard Sta	No	No	64.18%
Bus/TT	78	Arlmont Village to Harvard Sta	No	No	52.63%
Bus/TT	80	Arlington Ctr to Lechmere Sta	Yes	No	58.33%
Bus/TT	83	Rindge Ave to Central Sq, Cambridge	Yes	Yes	75.56%
Bus/TT	86	Sullivan Sq Sta to Reservoir (Cleveland Cir)	Yes	No	40.63%
Bus/TT	87	Arlington Ctr or Clarendon Hill to Lechmere Sta	Yes	No	68.57%
Bus/TT	88	Clarendon Hill to Lechmere Sta	Yes	Yes	80.00%
Bus/TT	89	Clarendon Hill to Sullivan Sq	Yes	No	89.47%
Bus/TT	91	Sullivan Sq Sta to Central Sq,Cambridge	Yes	Yes	80.43%
Bus/TT	93	Sullivan Sq Sta to Downtown via Bunker Hill St	No	No	66.67%
Bus/TT	94	Medford Sq to Davis Sq Sta	No	No	85.19%
Bus/TT	95	W Medford to Sullivan Sq Sta	No	No	51.43%
Bus/TT	96	Medford Squ to Harvard Sta	No	No	71.05%
Bus/TT	99	Boston Regional Med Ctr to Wellington Sta	No	No	55.88%
Bus/TT	100	Elm St to Wellington Sta	No	No	74.36%
Bus/TT	101	Malden Center Sta - Sullivan Sq Sta	No	No	34.21%
Bus/TT	104	Malden Ctr Sta to Sullivan Sq Sta	Yes	No	84.21%
Bus/TT	105	Malden Ctr Sta to Sullivan Sq Sta	Yes	No	70.00%
Bus/TT	106	Lebanon St, Malden to Wellington Sta	Yes	No	75.68%
Bus/TT	108	Linden Sq to Wellington Sta	No	No	50.00%
Bus/TT	109	Linden Sq to Sullivan Sq Sta	No	No	81.58%
Bus/TT	110	Wonderland or Park Ave. & Broadway to Wellington Sta	No	No	43.75%
Bus/TT	111	Woodlawn to Haymarket Sta	Yes	Yes	71.72%
Bus/TT	112	Wellington Sta to Wood Island Sta	Yes	Yes	47.62%
Bus/TT	116	Wonderland Sta to Maverick Sta	Yes	Yes	66.67%
Bus/TT	117	Wonderland Sta to Maverick Sta	Yes	Yes	57.14%
Bus/TT	119	Northgate to Beachmont Sta	No	No	86.36%
Bus/TT	120	Orient Heights to Maverick Sta	Yes	Yes	34.04%
Bus/TT	134	N Woburn to Wellington Sta	No	No	35.90%
Bus/TT	215	Quincy Ctr Sta to Ashmont Sta	No	No	76.19%
Bus/TT	216	Quincy Ctr Sta to Houghs Neck	No	No	62.50%
Bus/TT	220	Quincy Ctr Sta to Hingham or Fort Point	No	No	51.52%
Bus/TT	222	Quincy Ctr Sta to E Weymouth	No	No	97.06%
Bus/TT	225	Quincy Ctr Sta to Weymouth Landing	No	No	58.82%
Bus/TT	230	Quincy Ctr Sta to Brockton Line	No	No	83.33%
Bus/TT	236	Quincy Ctr Sta to S Shore Plaza	No	No	55.00%
Bus/TT	238	Quincy Ctr Sta to Holbrook/Randolph Commuter Rail Sta	No	No	45.45%
Bus/TT	240	Avon Line or Holbrook/Randolph Comm Rail Sta to Ashmont	No	No	58.82%
Bus/TT	350	N Burlington to Alewife Sta	No	No	61.29%
Bus/TT	426	Central Sq,Lynn & E Saugus to Haymarket Sta	No	No	50.00%
Bus/TT	429	Central Sq, Lynn to Linden Sq	No	No	25.00%

Table A-4A (Expanded)
Schedule Adherence (Typical Sunday)

Mode	Route	Route Name	Minority	Low Income	% On Time
Bus/TT	435	Lynn to Danvers via North Shore & Liberty Tree Malls	No	No	50.00%
Bus/TT	436	Goodwin Cir to Central Sq, Lynn	No	No	50.00%
Bus/TT	441	Marblehead to Haymarket or Dtwn Xing via Paradise St	No	No	12.50%
Bus/TT	442	Marblehead to Haymarket via Humphrey St	No	No	40.91%
Bus/TT	450	Salem Depot to Haymarket Sta	No	Yes	37.04%
Bus/TT	455	Salem Depot to Haymarket via Loring Ave & Central Sq, Lynn	Yes	No	43.75%
Bus/TT	CT3	Beth Israel Deaconess to Logan Airport	Yes	Yes	34.48%
CR	Rockport	Rockport - North Station	No		
CR	Newburyport	Newburyport - North Station	Yes		
CR	Haverhill	Haverhill - North Station	No		
CR	Lowell	Lowell - North Station	No		
CR	Fitchburg	Fitchburg - North Station	No		
CR	Worcester	Worcester - South Station	No		
CR	Franklin	Franklin - South Station	No		
CR	Providence	Providence - South Station	Yes		
CR	Middleborough	Middleborough/Lakeville - South Station	No		
CR	Plymouth/Kingston	Plymouth/Kingston - South Station	No		
RT	Green - B	Boston College - Government Center	Yes		
RT	Green - C	Cleveland Circle - Government Center	Yes		
RT	Green - D	Riverside - Lechmere	No		
RT	Green - E	Heath Street - Lechmere	Yes		
RT	Green Central Sub.	BC/Cleveland Circle/Riverside/Heath Street - Lechmere	Yes		
RT	Red - Mattapan	Mattapan - Ashmont	No		
RT	Red - Ashmont	Ashmont - Alewife	Yes		
RT	Red - Braintree	Braintree - Alewife	Yes		
RT	Red - Cambridge	Ashmont/Braintree - Alewife	Yes		
RT	Orange	Oak Grove - Forest Hills	Yes		
RT	Blue	Wonderland - Bowdoin	Yes		

Table 5A (Expanded)
Shelter Locations

Stop #	Stop Name	Municipality	90 Census Tract	Minority	Low Income
2464	Wadsworth Rd @ Dow Ave	Arlington	356500	No	No
2478	Lake Street @ Ramp to Rt. 2 East	Arlington	356700	No	No
12360	Park Ave @ Park Circle	Arlington	356600	No	No
8471	Springs Road @ Bedford VA Hospital	Bedford	359200	Yes	No
2134	Waverley Square	Belmont	357700	No	No
2135	Alexander Ave. @ Leonard St.	Belmont	357100	No	No
2326	East Service Road @ Park Ave	Belmont	357800	No	No
2331	East Service Road @ Pleasant St	Belmont	357100	No	No
2	Washington St @ Eustis St	Boston	080400	Yes	Yes
6	Melnea Cass Blvd @ Harrison Ave	Boston	080400	Yes	Yes
58	Mass Ave @ Harrison St	Boston	071000	Yes	No
82	Mass Ave @ Huntington Ave	Boston	010500	Yes	Yes
83	Mass Ave @ Columbus Ave	Boston	070800	Yes	Yes
90	Mass Ave @ Huntington Ave	Boston	010500	Yes	No
111	Monticello Ave @ Mt. Vernon St	Boston	090900	Yes	Yes
210	Summer Street @ Dry Dock Ave	Boston	060500	No	Yes
325	Park St (Bus Reservation) @ Dorchester Ave	Boston	092200	Yes	No
398	Warren St @ Dudley St	Boston	080400	Yes	Yes
591	Dorchester Ave @ Adams St	Boston	100900	Yes	No
595	Dorchester Ave @ Opp. #2165	Boston	100900	Yes	No
609	Washington Street @ LaGrange St	Boston	130300	No	No
854	Mass Ave @ Harrison Ave	Boston	071000	Yes	No
855	Mass Ave @ Albany St	Boston	080100	Yes	Yes
918	Washington St @ Chestnut Hill Ave	Boston	000202	Yes	No
921	Cambridge St @ Warren St	Boston	000601	Yes	No
1047	Western Ave @ Star Market	Boston	000100	Yes	No
1087	Chestnut Hill Ave @ Wiltshire Rd	Boston	000401	Yes	Yes
1195	Cambridge St @ Hano St	Boston	000802	Yes	No
1232	Tremont Street @ W. Concord	Boston	070900	Yes	Yes
1250	Tremont Street @ Worcester St	Boston	070900	Yes	Yes
1319	Tremont St @ Wigglesworth St	Boston	080900	Yes	No
1325	Humboldt Ave @ Seaver St	Boston	081900	Yes	Yes
1328	Humboldt Ave @ Crawford St	Boston	081900	Yes	Yes
1334	Humboldt Ave @ Humboldt Ct	Boston	081700	Yes	Yes
1475	Hancock St @ Bowdoin St	Boston	091500	Yes	Yes
1519	Brookline Ave @ Fullerton St	Boston	010200	Yes	Yes
1565	Franklin Park Loop @ Zoo entrance	Boston	110101	Yes	Yes
1589	Western Ave @ Riverdale St	Boston	000100	Yes	No
1778	Brookline Ave @ Short St	Boston	010300	Yes	Yes
1805	Brookline Ave @ Beth Israel Hospital	Boston	010300	Yes	Yes

Table 5A (Expanded)
Shelter Locations

Stop #	Stop Name	Municipality	90 Census Tract	Minority	Low Income
1807	Park Drive @ Fenway T Stop	Boston	010200	Yes	Yes
2564	N Harvard St @ Harvard Business School	Boston	000100	Yes	No
2823	Main St @ Oak St	Boston	040400	No	No
2853	Bunker Hill St @ Lowney Way	Boston	040200	No	Yes
5090	E Newton St @ Harrison Ave	Boston	071100	Yes	Yes
5227	Centre St @ Allandale St	Boston	120100	Yes	No
5245	Center St @ Faulkner Hospital	Boston	120100	Yes	No
5246	Center St @ Opp. Walter St	Boston	110601	No	No
5730	Meridian St @ Condor St	Boston	050100	Yes	Yes
5735	Meridian St @ Central Square	Boston	050200	Yes	Yes
6573	South Huntington @ #150	Boston	081100	Yes	Yes
8801	Neponset Circle @ Walnut St	Boston	100602	No	No
9401	Washington St @ Msgr. Reynolds St	Boston	071200	Yes	Yes
9434	Park Drive @ Fenway Station	Boston	010200	Yes	Yes
10820	VA Hospital	Boston	130402	No	No
11531	Jackson Square Station @ Orange Line	Boston	081200	Yes	Yes
11781	Ave Louis Pasteur @ Fenway	Boston	010300	Yes	Yes
15089	E Concord St @ Albany St	Boston	071000	Yes	No
16508	Hyde Park Ave @ River St	Boston	140300	Yes	Yes
26434	Cummins Highway @ Opp. Calvary Cem	Boston	140400	Yes	No
26466	Hyde Park Ave @ Number 1344	Boston	140300	Yes	Yes
30173	St. James St @ Dartmouth St	Boston	010600	Yes	No
31365	So. Huntington Ave @ Opp. VA Hospital	Boston	081100	Yes	Yes
31936	South Street @ Child St	Boston	120100	Yes	No
36479	Hyde Park Ave @ South Bourne St	Boston	110102	Yes	Yes
41111	Mt Vernon St @ #270	Boston	090900	Yes	Yes
42819	Hyde Park Ave @ Wolcott Square	Boston	140200	No	No
65741	South Huntington @ # 100	Boston	081100	Yes	Yes
81391	Huntington Ave #553 @ Mass College of Art	Boston	010300	Yes	Yes
3854	Independence Ave @ #41	Braintree	419200	No	No
4424	Howard St #129	Braintree	419300	No	No
39081	Washington St @ Water St	Braintree	419600	No	No
3988	Howard St @ Lisa Dr	Brockton	510100	No	No
1984	Boylston St @ Hammond St	Brookline	401100	No	No
6902	Chestnut Ave @ Cambridge St	Burlington	332100	No	No
8235	Cambridge St @ Bedford St	Burlington	332300	No	No
8241	Cambridge St @ Wayside Rd	Burlington	332200	No	No
16901	Parking lot @ Van De Graaff Drive	Burlington	332400	No	No
18246	Burlington Mall Rd @ Lahey Clinic #1	Burlington	332400	No	No
18249	Burlington Mall Rd @ Marriot Hotel	Burlington	332400	No	No

Table 5A (Expanded)
Shelter Locations

Stop #	Stop Name	Municipality	90 Census Tract	Minority	Low Income
75	Mass Ave @ MIT	Cambridge	353100	Yes	No
97	Mass Ave @ MIT Campus	Cambridge	353100	Yes	No
1772	Granite St @ Brookline St	Cambridge	353200	Yes	No
2030	Mt. Auburn Street @ Homer Ave	Cambridge	354300	Yes	No
2064	Mt. Auburn St. @ opp Homer	Cambridge	354300	Yes	No
2070	Mt. Auburn St. @ Mt Auburn Hospital	Cambridge	354200	No	No
2079	Aberdeen Ave. @ Huron Ave	Cambridge	354300	Yes	No
2096	Aberdeen Ave. @ Huron Ave	Cambridge	354300	Yes	No
2148	Concord Ave. @ opp Sancta Maria Hospital	Cambridge	354600	Yes	No
2152	Concord Ave. @ opp Fawcett St.	Cambridge	354600	Yes	No
2184	Concord Ave. @ Moulton	Cambridge	354600	Yes	No
2269	Massachusetts Avenue @ Cottage Park	Cambridge	355000	No	No
2273	Massachusetts Avenue @ Churchill St	Cambridge	355000	No	No
2296	Mass Ave @ Norris St	Cambridge	355000	No	No
2297	Mass. Ave., # 2254	Cambridge	354800	No	No
2299	Mass. Ave. @ Walden Park	Cambridge	354800	No	No
2425	Comeau Playground	Cambridge	354900	Yes	Yes
2429	Rindge Ave @ Mass Ave	Cambridge	354800	No	No
5607	Third St @ Broadway	Chelsea	160400	Yes	Yes
5616	Broadway @ City Hall Ave	Chelsea	160400	Yes	Yes
5617	City Hall Ave @ Riley Way	Chelsea	160400	Yes	Yes
15045	Spruce St @ Mystic Mall	Chelsea	160400	Yes	Yes
15048	Captains Row @ Admirals Hill	Chelsea	160300	No	Yes
15049	Captains Row @ Boatswains Way	Chelsea	160300	No	Yes
15050	Boatswains Way @ Admirals Way	Chelsea	160300	No	Yes
69618	Washington St @ High St	Dedham	402500	No	No
5484	Broadway @ Opp. Lynn St	Everett	342200	No	No
5508	Broadway @ Beacham St	Everett	342700	Yes	No
5564	Revere Beach Parkway @ After Rotary	Everett	342400	No	No
5565	Broadway @ Gladstone St	Everett	342400	No	No
5695	Broadway @ Osco Drug	Everett	342400	No	No
3587	Station St @ Water St	Hingham	501101	No	No
4010	N Franklin St @ Plymouth St	Holbrook	421200	No	No
39942	Linwood St @ Linwood Housing area	Holbrook	421100	No	No
4451	Market Square @ Western Av	Lynn	207100	Yes	No
4525	S Common St @ Elm St	Lynn	207100	Yes	No
4700	Broad Street @ after Market St	Lynn	206900	Yes	Yes
6600	Central Square @ Exchange Street	Lynn	206900	Yes	Yes
7292	Broadway @ Richardson	Lynn	205200	No	No
7347	Lynnfield Street @ Opp. Number 475	Lynn	205400	No	No

Table 5A (Expanded)
Shelter Locations

Stop #	Stop Name	Municipality	90 Census Tract	Minority	Low Income
5072	Malden Center Station @ West Bus Way	Malden	341200	No	No
5289	Centre St @ Stop & Shop Supermarket	Malden	341300	Yes	Yes
5340	Exchange St @ Opp. Washington St	Malden	341300	Yes	Yes
5342	Main St @ Opp. Pleasant St	Malden	341300	Yes	Yes
5367	Pleasant St @ Main St	Malden	341300	Yes	Yes
5368	S. Washington St @ Pleasant St	Malden	341300	Yes	Yes
5387	Bryant St @ Cross St	Malden	341800	Yes	No
5442	Salem St @ Pierce St	Malden	341600	No	No
5481	Broadway @ Opp. Burger King	Malden	341800	Yes	No
6266	Lynn St @ Beach St	Malden	341900	No	No
8336	Granada Highlands	Malden	341900	No	No
8338	Kennedy Dr @ Kennedy Dr	Malden	341900	No	No
9000	Sylvan St @ Kimball St	Malden	341600	No	No
2376	Boston Ave @ Winthrop St	Medford	339400	No	No
5269	Fellsway @ Myrtle St	Medford	339900	No	No
6569	Corp Way	Medford	339800	No	No
8302	Fellsway @ Elm St	Medford	339100	No	No
9042	Fellsway @ Riverside Ave	Medford	339800	No	No
9043	Fellsway @ bef Mystic Valley Pkwy	Medford	339800	No	No
9151	Riverside Ave @ 121 (apts)	Medford	339100	No	No
49157	Locust St @ Star Market	Medford	339800	No	No
49158	MeadowGlen Mall @ Main Entrance	Medford	339800	No	No
6647	Nahant Road @ Wilson Road	Nahant	201100	No	No
81440	Highland Ave @ Dana Place	Needham	403200	No	No
91852	Needham Junction @ Commuter Rail Station	Needham	403300	No	No
7631	Washington St @ after Walnut	Newton	373300	No	No
8167	Walnut St @ Washington St	Newton	373300	No	No
8171	Watertown St @ Chapel St	Newton	373200	No	No
8187	Watertown St @ Adams St	Newton	373200	No	No
8193	Walnut St @ opp. Clyde St	Newton	373400	No	No
8502	Parker St @ Cypress St	Newton	373800	No	No
8503	Cypress St @ Braeland St	Newton	373800	No	No
9031	Centre St @ Library	Newton	373100	No	No
82853	Walnut St @ Newtonville CR Station	Newton	373400	No	No
84881	Winchester @ Jewish Comm. Center	Newton	374000	No	No
60618	Washington St @ Railroad Av	Norwood	413200	No	No
61618	Washington St @ Opp. George St	Norwood	413200	No	No
3627	Washington St @ #585	Quincy	417901	No	Yes
3825	Scammell St @ Quincy Ave	Quincy	418002	No	No
3958	Franklin St @ North Payne St	Quincy	418001	No	No

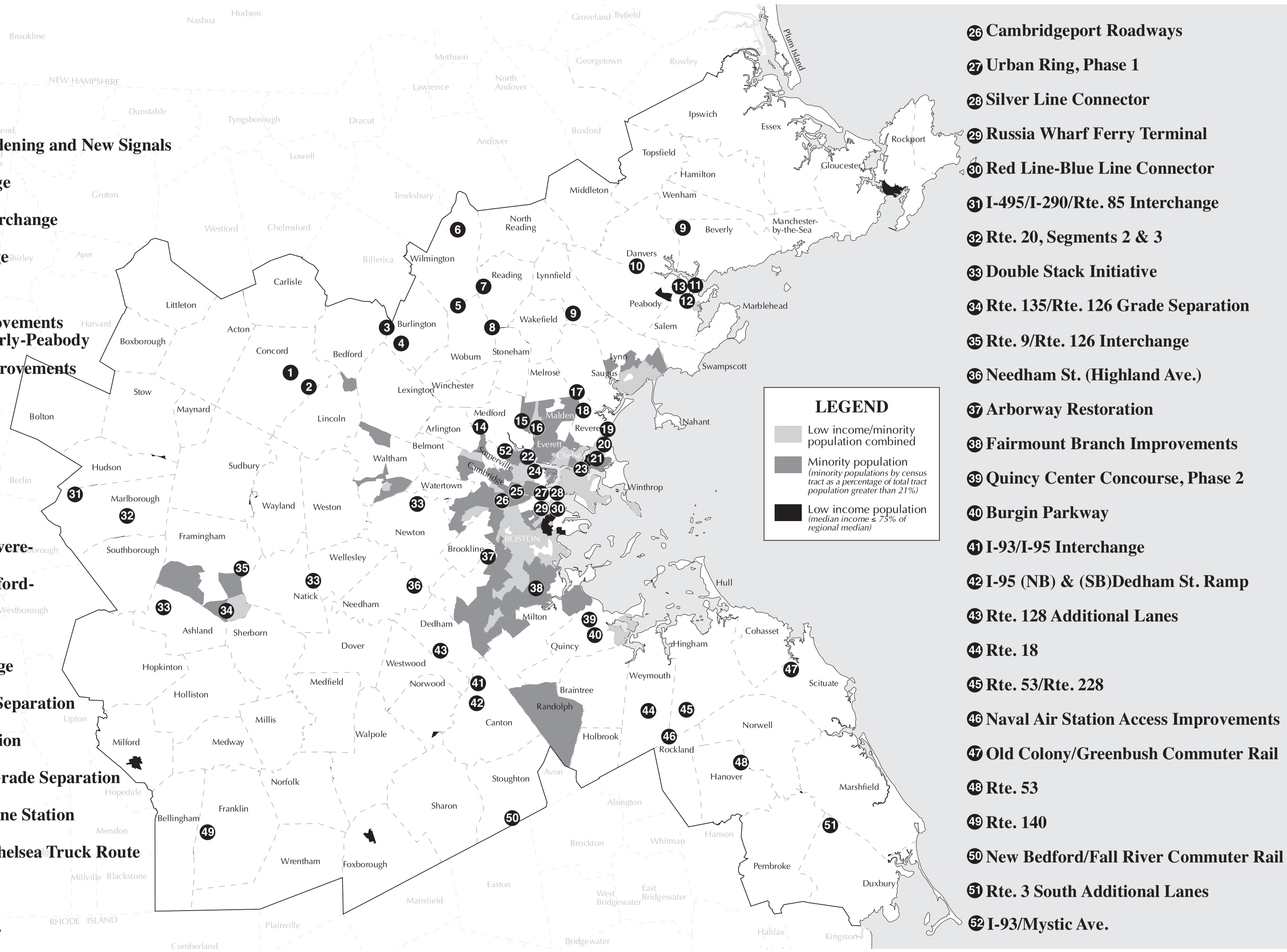
Table 5A (Expanded)
Shelter Locations

Stop #	Stop Name	Municipality	90 Census Tract	Minority	Low Income
4064	North St @ #203	Randolph	420301	No	No
4171	N Main St @ Reed St	Randolph	420200	No	No
4213	S. Main St @ N. Main St	Randolph	420302	Yes	No
4278	N Main St @ Opp. Warren St	Randolph	420302	Yes	No
4287	N Main St @ #641	Randolph	420100	No	No
4291	N Main St @ Oak St	Randolph	420200	No	No
43011	N Main St @ Russ Road	Randolph	420200	No	No
4496	Broadway @ Ward St	Revere	170400	No	No
4500	American Legion Hwy @ Revere St	Revere	170600	No	No
5713	Broadway @ Opp. Central Ave	Revere	170100	No	No
5781	Beach St @ North Shore Rd	Revere	170500	No	No
5805	Winthrop Ave @ Revere Beach Parkway	Revere	170600	No	No
4563	Washington Street @ after Federal Street	Salem	204500	No	No
16126	Loring Avenue @ Number 1000	Salem	204100	No	No
16170	Loring Avenue @ Salem State	Salem	204100	No	No
4495	Salem Turnpike @ Ballard St	Saugus	208102	No	No
7401	Lincoln Avenue @ Cliftondale Square	Saugus	208101	No	No
2380	College Ave @ Professors Row	Somerville	350400	No	No
2381	College Ave @ Powder House Square	Somerville	350600	No	No
2637	Clarendon Hill	Somerville	350700	No	No
2659	McGrath Highway @ Allston St	Somerville	351400	Yes	Yes
2688	Medford St @ Highland Ave	Somerville	351300	Yes	Yes
2689	McGrath Highway @ Before Prospect Hill	Somerville	351300	Yes	Yes
2705	Broadway @ Opp. Temple St	Somerville	350200	No	No
2725	Broadway @ Opp. Marshall St	Somerville	350200	No	No
2880	Mystic Ave @ Shore Drive	Somerville	350100	Yes	No
2900	Mystic Ave @ Temple St	Somerville	350100	Yes	No
12759	Washington St @ Myrtle St	Somerville	351500	Yes	Yes
23891	Pearl St @ Opp Bradley St	Somerville	351400	Yes	Yes
32878	Assembly Square Mall @ Mall Entrance	Somerville	350100	Yes	No
32879	Assembly Sq Mall @ K-Mart/McDonalds	Somerville	350100	Yes	No
4914	Humphrey Street @ Monument Street	Swampscott	202200	No	No
7699	Beaver St @ Bentley College	Waltham	368901	No	No
18926	Wyman St @ After Arkwright Insurance	Waltham	368102	No	No
86928	Weston St @ Cedarwood Ave	Waltham	368400	No	No
86944	Carter St @ Waltham CR Station	Waltham	368800	Yes	No
86944	Carter St @ Waltham CR Station	Waltham	368800	Yes	No
88333	Carter St @ RR	Waltham	368800	Yes	No
900	Watertown Yard	Watertown	370400	No	No
1445	Arsenal St @ Bradlees	Watertown	370300	No	No

Table 5A (Expanded)
Shelter Locations

Stop #	Stop Name	Municipality	90 Census Tract	Minority	Low Income
8178	Watertown Square @ Bus Turn-around	Watertown	370102	No	No
8179	Watertown St @ Galen St	Watertown	370102	No	No
8815	Main St @ Watertown Sq	Watertown	370102	No	No
82971	Main St @ Watertown Sq	Watertown	370102	No	No
50619	Washington St @ East St	Westwood	412300	No	No
3611	Bridge St @ Neck St	Weymouth	422800	No	No
3612	Bridge St @ Lovell St	Weymouth	422800	No	No
3616	Bridge St @ Newton Ct	Weymouth	422800	No	No
3697	North St @ Commercial St	Weymouth	422600	No	No
36845	Water Street @ Opp. Myrtle St	Weymouth	422501	No	No
37079	Washington St @ Broad St	Weymouth	422400	No	No
8244	Cambridge St @ South Bedford Stl	Woburn	333100	No	No
8248	Cambridge St @ Russell St	Woburn	333100	No	No
8248	Cambridge St @ Russell St	Woburn	333100	No	No
18244	Cambridge St @ Sylvanus Wood Lane	Woburn	333100	No	No
49824	Pleasant St @ Arlington Rd	Woburn	333200	No	No

MAP A-1
Projects Included in the Recommended Plan in Relation to Low Income and Minority Communities



1. Concord Rotary
2. Rte. 2/Crosby's Corner
3. Crosby Dr.
4. Middlesex Turnpike Widening and New Signals
5. New Boston Street Bridge
6. I-93/Ballardvale St. Interchange
7. I-93/Rte. 129 Interchange
8. I-93/I-95 Interchange
9. Rte. 128 Capacity Improvements Lynnfield-Reading/Beverly-Peabody
10. Rte. 1/114 Corridor Improvements
11. Bridge St.
12. Bridge St. Bypass
13. Boston St.
14. Green Line to Medford
15. Everett, Medford & Revere-Revere Beach Parkway
16. Everett, Malden & Medford-Telecom City Roadways
17. Rte. 1 Improvements
18. Rte. 1/Rte. 16 Interchange
19. Mahoney Circle Grade Separation
20. Rte. 1A/Rte. 16 Connection
21. Rte. 1A/Boardman St. Grade Separation
22. Assembly Sq. Orange Line Station
23. East Boston Haul Rd./Chelsea Truck Route
24. Rutherford Avenue
25. Mass. Ave./Lafayette Sq.
26. Cambridgeport Roadways
27. Urban Ring, Phase 1
28. Silver Line Connector
29. Russia Wharf Ferry Terminal
30. Red Line-Blue Line Connector
31. I-495/I-290/Rte. 85 Interchange
32. Rte. 20, Segments 2 & 3
33. Double Stack Initiative
34. Rte. 135/Rte. 126 Grade Separation
35. Rte. 9/Rte. 126 Interchange
36. Needham St. (Highland Ave.)
37. Arborway Restoration
38. Fairmount Branch Improvements
39. Quincy Center Concourse, Phase 2
40. Burgin Parkway
41. I-93/I-95 Interchange
42. I-95 (NB) & (SB)Dedham St. Ramp
43. Rte. 128 Additional Lanes
44. Rte. 18
45. Rte. 53/Rte. 228
46. Naval Air Station Access Improvements
47. Old Colony/Greenbush Commuter Rail
48. Rte. 53
49. Rte. 140
50. New Bedford/Fall River Commuter Rail
51. Rte. 3 South Additional Lanes
52. I-93/Mystic Ave.

MEMORANDUM

TO: **David Mohler** **May 15, 2001**
Certification Activities

FROM: **Clinton Bench, Manager**
Transit Service Planning

RE: **Method for Choosing Locations in**
Environmental Justice Mobility Review

In accordance with the recommendations of the Environmental Justice Ad Hoc Committee of the Boston MPO, CTPS will conduct a review of the relative mobility of transit customers in minority vs. non-minority neighborhoods and in low income vs. non-low income neighborhoods. The mobility of these customers will be defined in terms of travel times to key employment/commercial districts from select residential neighborhoods. The selection criteria for these locations is explained below.

SELECTION CRITERIA

Residential Neighborhoods

In order to select key residential origins in a systematic and unbiased manner, the following approach was used. First, the top 80 census tracts in terms of residential density were identified. These top 80 tracts were divided into four tiers of twenty according to their relative ranking. Then, for each of these tiers of twenty tracts, the tract with the highest percentage of minority population and the tract with the lowest percentage of minority population was selected. This resulted in eight locations, which represent: 1. Heavily populated and transit accessible predominantly minority neighborhoods, and 2. Heavily populated and transit accessible predominantly non-minority neighborhoods:

Minority
Mission Hill
Grove Hall
Bromley-Heath Housing
Dorchester Four Corners

Non Minority
South Boston Telegraph Hill
North End
Charlestown Bunker Hill
Somerville Powderhouse Square

Since these eight locations do not provide broad geographic diversity, six additional locations were selected to represent other neighborhoods with high residential density. In particular, the tract with the most dense residential development was selected for each of the following communities: Allston/Brighton, Cambridge, South End/Back Bay, East Boston, Chelsea, and Lynn. These locations had relatively equal populations of minority and non minority residents and are listed below:

East Brighton
Cambridge Riverside
South End Center
East Boston Central Square
Chelsea Bellingham Square
Lynn Washington Street

A similar procedure was followed for low-income and non low-income neighborhoods. The 80 most densely developed residential neighborhoods were divided into the same tiers of twenty described above. Then for each of these tiers of twenty, the census tracts with the highest household incomes and the lowest household incomes were chosen. This resulted in eight locations, which represent: 1. Heavily populated and transit accessible largely poor neighborhoods, and 2. Heavily populated and transit accessible largely wealthy neighborhoods:

Low Income
Mission Hill
South Boston Telegraph Hill
South Boston West Broadway
Lynn Washington Street

Non Low Income
Brookline Coolidge Corner
South End Center
Charlestown Bunker Hill
Mid-Cambridge

Since these eight locations do not provide broad geographic diversity, six additional locations were selected to represent other neighborhoods with high residential density. In particular, the tract with the most dense residential development was selected for each of the following communities: Allston/Brighton, Cambridge, Roxbury/Dorchester, East Boston, Chelsea, and Somerville. Each of these locations except Winter Hill had median household incomes less than 75% of the metropolitan area average:

East Brighton
Cambridge Riverside
Grove Hall
East Boston Central Square
Chelsea Bellingham Square
Somerville Winter Hill

Employment/Commercial Districts

In order to select key employment/commercial destinations in a systematic and non-biased manner, the 100 census tracts with the most employment per square mile were identified. When displayed on a metropolitan area map, these census tracts are generally clustered in the urban core of Boston and Cambridge. Within this urban core, six representative locations were chosen based on substantial mixed-use development including commercial establishments, health care, and opportunities for higher education. These locations are as follows:

Post Office Square
Copley Square
Boston Medical Center
Longwood Medical Area
Kendall Square
Harvard Square

Beyond the urban core, five other inner suburban clusters of employment development appeared based on visual inspection of the employment density map. These clusters were located in Quincy, Newton/Watertown/Waltham, Malden, Lynn, and Salem. Among these areas, five locations were chosen as attractive employment destinations. Again, each of these locations claim substantial mixed-use development with two or more of the following: Commercial establishments, health care, and opportunities for higher education. These locations are as follows:

Quincy Center
Waltham Central Square

Malden Center
Lynn Central Square
Salem Center

Finally, three additional locations were chosen in more distant suburban locations to represent areas of substantial commercial growth. In the case of two of these locations, major health care centers are also nearby:

South Shore Plaza
Burlington Mall
North Shore Mall

CSB/CSB/csb

Mobility Analysis

One of the measures of environmental justice adopted by the MPO is a review of transit mobility using the selected origins and destinations listed below. The selection method for choosing these locations is described in detail in the preceding memorandum.

Origins

3	North End (Prince Street @ Snowhill Street)
63	South End Center (Tremont Street @ Clarendon Street)
70	East Boston Central Square
84	Charlestown (Central - Main Street @ Walker Street)
99	Brigham Circle
109	Brighton (Eastside - Warren Street @ Commonwealth Avenue)
127	Grove Hall (Blue Hill Avenue @ Washington Street)
131	Bromley-Heath Housing (Roxbury)
151	South Boston (West Broadway @ B Street)
152	South Boston (Old Colony Avenue @Dorchester Street)
168	Dorchester Four Corners (Dorchester)
204	Chelsea Bellingham Square
245	Somerville Winter Hill (Broadway @ School Street)
254	Somerville Powder House Square
269	Mid Cambridge (Broadway @ Fayette Street)
274	Cambridge Riverside (Putnam Avenue @ Kinnaird Street)
294	Brookline Coolidge Corner
308	Lynn (Central - Washington Street @ Essex Street)

Destinations:

30	Post Office Square (Milk Street @ Congress Street)
47	Copley Square (Dartmouth Street @ Boylston Street)
68	Boston Medical Center (East Concord Street @ Harrison Avenue)
94	Longwood Medical Area (Longwood Avenue @ Avenue Louis Pasteur)
226	Malden Center (Exchange Street @ Washington Street)
260	Kendall Square (Broadway @ Galileo Way)
278	Harvard Square
304	Lynn Central Square (Union Street @ Exchange Street)
386	Waltham Central Square (Moody Street @ Main Street)
435	Quincy Center (Washington Street @ Hancock Street)
455	Salem Center (Washington Street @ New Derby Street)
476	North Shore Plaza
526	Burlington Mall
688	South Shore Plaza

The following three tables provide information on transit times, trip distances, and travel speeds between each of these locations. Based upon this information:

- the average travel speed from minority neighborhoods is 6.79 miles per hour;
- the average travel speed from non-minority neighborhoods is 7.15 miles per hour;
- the average travel speed from low-income neighborhoods is 7.59 miles per hour;
- the average travel speed from non-low-income neighborhoods is 6.66 miles per hour.

Transit Model Assignment Times (in minutes)

model year 2000, AM peak period

o/d	30	47	68	94	226	260	278	304	386	435	455	476	526	688
3	29.11	27.72	38.72	37.32	32.80	26.70	31.20	52.65	72.86	40.80	81.60	174.64	84.43	49.60
63	23.57	14.20	13.80	26.97	33.60	27.00	31.50	78.37	74.94	34.00	86.30	199.76	98.11	42.80
70	27.35	25.97	33.80	35.10	33.40	31.68	36.18	50.65	77.83	44.05	80.97	171.90	93.78	52.85
84	31.02	28.70	34.40	35.50	25.00	32.50	43.55	68.35	78.15	44.65	97.30	190.34	100.13	53.45
99	27.95	21.30	27.77	13.00	37.50	35.40	42.86	81.00	78.42	44.65	90.20	192.63	113.24	53.45
109	38.15	29.00	44.25	35.71	51.95	37.41	29.87	92.62	66.34	54.85	101.82	204.25	100.25	63.65
127	43.95	38.69	34.59	33.07	53.19	50.40	53.76	108.42	93.28	55.70	105.90	208.33	124.94	68.00
131	27.75	22.80	24.70	27.73	37.30	33.35	37.85	80.80	81.79	44.45	90.00	192.43	104.46	53.25
151	20.60	27.36	28.92	39.90	36.60	23.00	27.50	91.64	69.16	30.00	89.30	191.73	94.11	38.80
152	23.60	32.99	28.72	44.44	41.55	26.00	30.50	98.08	72.16	29.30	94.25	196.68	97.11	38.10
168	35.50	41.52	42.68	41.65	53.45	37.90	42.40	116.99	84.06	46.29	106.15	208.58	109.01	51.20
204	38.05	36.67	44.50	45.80	44.10	42.38	46.88	67.60	88.53	54.75	65.70	168.13	97.98	63.55
246	32.45	33.20	38.90	40.00	28.40	38.03	35.40	80.87	75.50	49.15	87.80	202.87	94.16	57.95
254	31.70	37.08	46.55	46.20	48.60	24.70	18.70	85.96	66.86	45.20	101.02	207.96	69.31	54.00
269	27.80	33.18	44.17	45.06	44.70	17.20	14.40	99.23	53.56	41.30	101.23	203.66	87.45	50.10
274	27.60	32.98	53.53	42.10	44.50	20.60	10.60	94.51	47.73	41.10	96.92	199.35	82.24	49.90
294	37.85	28.70	43.95	24.40	51.65	42.80	34.40	92.32	75.06	54.55	101.52	203.95	104.78	63.35
308	62.84	61.71	69.29	71.31	76.61	62.69	71.89	11.80	107.69	79.54	60.36	136.90	125.92	88.34

Distances Between Zones

o/d	30	47	68	94	226	260	278	304	386	435	455	476	526	688
3	0.76	1.54	2.40	3.05	4.04	1.62	3.21	8.80	8.64	8.29	13.49	13.13	11.18	10.29
63	1.09	0.60	0.65	1.72	5.54	1.58	3.15	10.49	8.18	7.12	15.20	14.89	11.91	8.91
70	1.49	2.48	3.18	4.02	4.01	2.61	4.11	7.91	9.55	8.40	12.62	12.42	11.60	10.53
84	1.77	2.07	3.15	3.29	3.04	1.54	2.63	8.60	8.01	9.35	13.21	12.59	10.10	11.30
99	2.99	1.95	1.64	0.58	6.55	2.32	2.85	12.28	6.78	7.55	16.95	16.42	11.64	8.89
109	4.39	3.33	3.67	2.09	6.16	2.93	1.93	12.84	4.55	9.78	17.36	16.38	9.70	10.98
127	3.59	2.94	1.90	2.34	7.97	3.73	4.67	12.91	8.40	5.75	17.63	17.43	13.50	7.03
131	3.23	2.27	1.69	1.08	7.02	2.76	3.36	12.60	7.08	7.15	17.29	16.82	12.12	8.42
151	1.24	1.48	1.05	2.57	6.02	2.43	4.07	10.28	9.11	6.39	15.01	14.92	12.74	8.31
152	1.69	1.98	1.35	2.93	6.47	2.94	4.56	10.44	9.53	5.90	15.17	15.18	13.25	7.86
168	3.85	3.41	2.28	3.08	8.45	4.29	5.38	12.96	9.22	4.93	17.69	17.64	14.25	6.28
204	2.75	3.65	4.45	5.13	3.29	3.52	4.74	6.69	10.06	9.51	11.38	11.12	11.23	11.71
245	2.81	2.47	3.57	2.98	3.06	1.50	1.32	9.67	6.53	10.18	14.15	13.20	8.91	11.94
254	4.56	4.12	5.16	4.22	3.04	3.14	1.91	10.28	5.45	11.83	14.51	13.15	7.19	13.48
269	2.69	2.05	3.05	2.22	3.87	1.09	0.73	10.38	6.16	9.72	14.90	14.01	9.28	11.38
274	3.15	2.35	3.22	2.10	4.31	1.51	0.24	10.96	5.60	9.87	15.46	14.51	9.13	11.42
294	3.99	2.90	3.04	1.47	6.40	2.72	2.21	12.81	5.25	9.01	17.40	16.57	10.44	10.20
308	9.48	10.38	11.18	11.81	7.02	10.10	10.86	0.73	15.43	15.07	4.65	4.93	13.31	17.46

Transit Speeds in Minutes

model year 2000, AM peak period

o/d	30	47	68	94	226	260	278	304	386	435	455	476	526	688
3	1.57	3.33	3.72	4.90	7.39	3.64	6.17	10.03	7.12	12.19	9.92	4.51	7.95	12.45
63	2.77	2.54	2.83	3.83	9.89	3.51	6.00	8.03	6.55	12.56	10.57	4.47	7.28	12.49
70	3.27	5.73	5.64	6.87	7.20	4.94	6.82	9.37	7.36	11.44	9.35	4.34	7.42	11.95
84	3.42	4.33	5.49	5.56	7.30	2.84	3.62	7.55	6.15	12.56	8.15	3.97	6.05	12.68
99	6.42	5.49	3.54	2.68	10.48	3.93	3.99	9.10	5.19	10.15	11.27	5.11	6.17	9.98
109	6.90	6.89	4.98	3.51	7.11	4.70	3.88	8.32	4.12	10.70	10.23	4.81	5.81	10.35
127	4.90	4.56	3.30	4.25	8.99	4.44	5.21	7.14	5.40	6.19	9.99	5.02	6.48	6.20
131	6.98	5.97	4.11	2.34	11.29	4.97	5.33	9.36	5.19	9.65	11.53	5.24	6.96	9.49
151	3.61	3.25	2.18	3.86	9.87	6.34	8.88	6.73	7.90	12.78	10.09	4.67	8.12	12.85
152	4.30	3.60	2.82	3.96	9.34	6.78	8.97	6.39	7.92	12.08	9.66	4.63	8.19	12.38
168	6.51	4.93	3.21	4.44	9.49	6.79	7.61	6.65	6.58	6.39	10.00	5.07	7.84	7.36
204	4.34	5.97	6.00	6.72	4.48	4.98	6.07	5.94	6.82	10.42	10.39	3.97	6.88	11.06
246	5.20	4.46	5.51	4.47	6.46	2.37	2.24	7.17	5.19	12.43	9.67	3.90	5.68	12.36
254	8.63	6.67	6.65	5.48	3.75	7.63	6.13	7.18	4.89	15.70	8.62	3.79	6.22	14.98
269	5.81	3.71	4.14	2.96	5.19	3.80	3.04	6.28	6.90	14.12	8.83	4.13	6.37	13.63
274	6.85	4.28	3.61	2.99	5.81	4.40	1.36	6.96	7.04	14.41	9.57	4.37	6.66	13.73
294	6.32	6.06	4.15	3.61	7.43	3.81	3.85	8.33	4.20	9.91	10.28	4.87	5.98	9.66
308	9.05	10.09	9.68	9.94	5.50	9.67	9.06	3.71	8.60	11.37	4.62	2.16	6.34	11.86

Percent Change in Travel Speeds

Percentage change model year 2000, AM peak period to model year 2025 "build", AM peak period

o/d	30	47	68	94	226	260	278	304	386	435	455	476	526	688
3	0.00%	0.00%	0.00%	0.00%	0.00%	3.09%	0.00%	2.91%	0.00%	0.00%	4.11%	0.92%	0.00%	0.00%
63	0.73%	0.00%	0.00%	0.00%	0.00%	-4.26%	-5.97%	9.30%	4.05%	0.00%	-15.81%	3.45%	-2.00%	0.00%
70	2.05%	0.00%	-5.80%	0.00%	0.00%	40.18%	29.68%	0.02%	11.89%	9.31%	0.00%	0.00%	-0.77%	7.64%
84	0.00%	0.00%	-6.52%	-2.61%	0.00%	-16.39%	5.14%	2.23%	0.00%	-1.22%	3.42%	0.84%	-2.73%	-1.02%
99	-0.18%	0.00%	13.67%	0.00%	0.00%	-0.73%	0.00%	-4.71%	3.27%	-0.11%	0.00%	-6.67%	0.00%	-0.09%
109	-0.91%	0.00%	-1.45%	0.00%	-0.29%	1.41%	0.00%	-0.09%	0.00%	-0.63%	0.00%	-4.60%	0.00%	-0.55%
127	0.23%	0.00%	-8.93%	-0.21%	0.00%	0.06%	-1.32%	6.57%	-2.83%	0.00%	0.00%	-6.63%	0.66%	0.00%
131	-0.18%	0.00%	0.00%	12.95%	0.00%	0.76%	-1.43%	0.00%	2.16%	-0.11%	0.00%	0.00%	-0.52%	-0.09%
151	0.00%	0.00%	9.71%	0.00%	0.00%	3.60%	0.00%	7.85%	0.00%	0.00%	0.00%	-7.09%	0.00%	0.00%
152	0.00%	0.00%	9.79%	2.94%	-1.31%	3.17%	0.00%	7.31%	0.00%	0.00%	-0.58%	-7.57%	0.00%	0.00%
168	17.55%	23.28%	25.23%	6.74%	10.89%	14.85%	10.70%	21.79%	5.13%	0.00%	5.20%	-4.08%	3.91%	-4.66%
204	1.47%	0.00%	-4.47%	0.00%	0.00%	27.27%	21.45%	26.36%	10.30%	7.35%	4.78%	1.82%	1.00%	6.27%
245	-0.15%	-0.90%	-5.81%	-7.19%	0.00%	9.16%	0.00%	-7.88%	0.00%	-1.11%	-2.01%	5.64%	0.00%	-0.94%
254	0.00%	5.04%	3.67%	2.90%	7.52%	3.35%	0.00%	1.79%	0.00%	0.00%	10.53%	7.29%	0.00%	0.00%
269	0.00%	-5.25%	16.18%	12.20%	9.56%	-31.01%	0.00%	17.61%	0.00%	0.00%	-9.29%	-1.26%	0.00%	0.00%
274	0.00%	0.00%	31.20%	0.00%	0.00%	4.04%	0.00%	1.86%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
294	-0.92%	0.00%	-1.46%	0.00%	-0.29%	1.90%	0.00%	-0.09%	0.00%	-0.64%	0.00%	-4.60%	0.00%	-0.55%
308	-0.08%	0.00%	-3.24%	0.00%	0.00%	-22.07%	-16.15%	0.00%	0.00%	-0.69%	0.00%	0.00%	0.78%	-0.62%

APPENDIX B

UNIVERSE OF PROJECTS

One of the primary outcomes of the Regional Transportation Plan is the development of a list of major capital expansion projects for implementation over the next 25 years. To select these projects, the MPO first created a Universe of Projects – a list of all possible projects for selection. The Universe of Projects comprises projects included in a previously adopted Regional Transportation Plan; projects previously studied, under study or in development; projects included in comments received on the 2000 Plan; and projects identified through the Plan Update planning process in 2001.

Universe of Projects for the 2025 Build Scenario[1]

Projects Previously Included in an Adopted Future Build Scenario

Highway Projects

Community	Project	Cost[2]	Source
Bedford	Crosby Dr.	$3,500,000	2000
Bedford & Burlington	Middlesex Turnpike	$9,000,000	2000
Burlington	Rte. 3A	$3,000,000	1998
Cambridge	Mass. Ave./Lafayette Sq.	$4,400,000	2000
Cambridge	Cambridgeport Roadways	$3,000,000	2000
Canton	East/West Connector Rd.	$7,200,000	1998
Canton	I-95 (SB)/Dedham St. Onramp	$1,200,000	2000
Concord & Lincoln	Rte. 2/Crosby's Corner	$17,500,000	2000
Danvers & Peabody	Rte. 1/114 Corridor Improvements	$40,000,000	1997
Everett, Malden & Medford	Telecom City Roadways	$24,900,000	2000
Framingham	Rte. 126/Rte. 135 Grade Separation	$50,000,000	1997
Franklin	Rte. 140	$18,000,000	2000
Hanover	Rte. 53	$4,000,000	2000
Hingham & Norwell	Rte. 53/Rte. 228	$2,500,000	1998
Marlborough	Rte. 20, Segments 2 & 3	$7,200,000	2000
Marlborough & Northborough	Boundary St./Goddard Rd. Connection	$2,500,000	1998
Needham & Newton	Needham St. (Highland Ave.)	$6,600,000	2000
Quincy	Quincy Center Concourse, Phase 2	$6,000,000	1997
Randolph to Wellesley	Rte. 128 Additional Lanes	$97,000,000	2000
Reading & Wilmington	I-93/Rte. 129 Interchange	$15,000,000	1998
Salem	Boston St.	$1,100,000	1998
Salem	Bridge St. Bypass	$12,300,000	2000
Salem	Bridge St.	$3,000,000	1997
Weymouth	Rte. 18	$15,000,000	1998
Weymouth to Duxbury	Rte. 3 South Additional Lanes	$180,000,000	1997

Transit Projects

Community	Project	Cost[2]	Source
Boston	Red Line/Blue Line Pedestrian Connection	$5,000,000	1997
Boston	Red Line/Blue Line Connector	$220,000,000	2000
Boston	Russia Wharf Ferry Terminal	$5,000,000	2000
Boston[3]	Silver Line, Phase 3	$713,000,000	2000
Boston to New Bedford	New Bedford/Fall River Commuter Rail	$610,000,000	1997
Boston to Scituate	Greenbush Commuter Rail	$400,000,000	2000
Boston, Medford & Somerville	Medford Hillside Green Line	$375,000,000	2000
Stoughton to Easton	Commuter Rail Extension	$16,000,000	1997
Weston	Masspike/Rte. 128 Station	$2,000,000	1997
		$1,989,500,000	

[1] This listing does not include projects from the Base Case or No-Build Scenario or projects that would not normally be included in a regional transportation model.

[2] Where possible, the cost estimates included here have been updated with the most recent information. Some, however, cannot be updated and may be suspect.

[3] Only 50% of this project's costs are chargeable to MBTA revenues; the rest will be pursued at the at the federal level via New Start funding.

Universe of Projects for the 2025 Build Scenario[1]

Projects Previously Studied, Currently under Study, or in Development

Highway Projects

Community	Project	Cost[2]
Boston	Fenway Park Highway Improvements	$26,000,000
Boston	Rte. 1A/Boardman St. Grade Separation	$8,500,000
Boston	Rutherford Avenue	$50,000,000
Boston & Chelsea	Rte. 1A/Chelsea St. Bridge Connection	$34,800,000
Canton	I-93/I-95 Interchange	$27,500,000
Canton	I-95 (NB)/Dedham St. Ramp	$3,000,000
Concord	Concord Rotary	$35,000,000
Hingham, Rockland & Weymouth	Naval Air Station Access Improvements	$87,500,000
Hudson & Marlborough	I-495/I-290/Rte. 85	$25,000,000
Littleton	Rte. 2 Interchange	$10,000,000
Malden & Revere	Rte. 1 Improvements	$33,600,000
Reading & Woburn	I-93/I-95 Interchange	$75,000,000
Revere	Mahoney Circle Grade Separation	$25,000,000
Revere	Rte. 1/Rte. 16 Interchange	$3,900,000
Revere	Rte. 1A/Rte. 16 Connection	$39,600,000
Salem	Commercial St./Tremont St.	$500,000
Salem	Essex St. Conversion	$2,000,000
Somerville	I-93/Mystic Ave. Interchange	$50,000,000
Wilmington	I-93/Ballardvale St. Interchange	$15,000,000

Transit Projects

Community	Project	Cost[2]
Boston	North/South Rail Link	TBD
Boston	Yawkey Station Upgrade	$25,000,000
Framingham to Marlborough	Commuter Rail Extension	$159,000,000
Inner Core	Urban Ring, Phase 1	$100,000,000
Inner Core	Urban Ring, Phase 2	$500,000,000
Inner Core	Urban Ring, Phase 3	$2,000,000,000
Littleton	New Commuter Rail Station	$4,000,000
North Shore	North Shore Transit Improvements	TBD
Revere to Lynn	Blue Line Extension	$292,000,000
		$3,080,000,000

[1] This listing does not include projects from the Base Case or No-Build Scenario or projects that would not normally be included in a regional transportation model.

[2] Where possible, the cost estimates included here have been updated with the most recent information. Some, however, cannot be updated and may be suspect.

Universe of Projects for the 2025 Build Scenario[1]

Projects Previously Included in an Adopted Future Build Scenario

Highway Projects

Community	Project	Cost[2]	Source
Bedford	Crosby Dr.	$3,500,000	2000
Bedford & Burlington	Middlesex Turnpike	$9,000,000	2000
Burlington	Rte. 3A	$3,000,000	1998
Cambridge	Mass. Ave./Lafayette Sq.	$4,400,000	2000
Cambridge	Cambridgeport Roadways	$3,000,000	2000
Canton	East/West Connector Rd.	$7,200,000	1998
Canton	I-95 (SB)/Dedham St. Onramp	$1,200,000	2000
Concord & Lincoln	Rte. 2/Crosby's Corner	$17,500,000	2000
Danvers & Peabody	Rte. 1/114 Corridor Improvements	$40,000,000	1997
Everett, Malden & Medford	Telecom City Roadways	$24,900,000	2000
Framingham	Rte. 126/Rte. 135 Grade Separation	$50,000,000	1997
Franklin	Rte. 140	$18,000,000	2000
Hanover	Rte. 53	$4,000,000	2000
Hingham & Norwell	Rte. 53/Rte. 228	$2,500,000	1998
Marlborough	Rte. 20, Segments 2 & 3	$7,200,000	2000
Marlborough & Northborough	Boundary St./Goddard Rd. Connection	$2,500,000	1998
Needham & Newton	Needham St. (Highland Ave.)	$6,600,000	2000
Quincy	Quincy Center Concourse, Phase 2	$6,000,000	1997
Randolph to Wellesley	Rte. 128 Additional Lanes	$97,000,000	2000
Reading & Wilmington	I-93/Rte. 129 Interchange	$15,000,000	1998
Salem	Boston St.	$1,100,000	1998
Salem	Bridge St. Bypass	$12,300,000	2000
Salem	Bridge St.	$3,000,000	1997
Weymouth	Rte. 18	$15,000,000	1998
Weymouth to Duxbury	Rte. 3 South Additional Lanes	$180,000,000	1997

Transit Projects

Community	Project	Cost[2]	Source
Boston	Red Line/Blue Line Pedestrian Connection	$5,000,000	1997
Boston	Red Line/Blue Line Connector	$220,000,000	2000
Boston	Russia Wharf Ferry Terminal	$5,000,000	2000
Boston[3]	Silver Line, Phase 3	$713,000,000	2000
Boston to New Bedford	New Bedford/Fall River Commuter Rail	$610,000,000	1997
Boston to Scituate	Greenbush Commuter Rail	$400,000,000	2000
Boston, Medford & Somerville	Medford Hillside Green Line	$375,000,000	2000
Stoughton to Easton	Commuter Rail Extension	$16,000,000	1997
Weston	Masspike/Rte. 128 Station	$2,000,000	1997
		$1,989,500,000	

[1] This listing does not include projects from the Base Case or No-Build Scenario or projects that would not normally be included in a regional transportation model.

[2] Where possible, the cost estimates included here have been updated with the most recent information. Some, however, cannot be updated and may be suspect.

[3] Only 50% of this project's costs are chargeable to MBTA revenues; the rest will be pursued at the at the federal level via New Start funding.

Universe of Projects for the 2025 Build Scenario[1]

Projects Included in Comments on the 2000 RTP (cont)[2]

Transit Projects (cont.)

Community	Project
Regionwide	Commuter Rail Extensions
Regionwide	Expansion of Carpool/Vanpool Parking
Regionwide	Expansion of Transit Parking
Regionwide	Increased TMA/TDM Programs
Regionwide	Increases to the Inter-District Program
Regionwide	ITS Transit Projects
Regionwide	New "Infill" Stations on Transit Routes
Regionwide	New and Improved Ferry Service
Regionwide	New busways, but not on Washington St.
Regionwide	Shuttle Bus/Commuter Rail Connections
Regionwide	Transit Frequency Improvements
Regionwide	Use of Road-Railers
Salem to Peabody	Commuter Rail Service
Somerville	Assembly Sq. Orange Line Station
Subregion (NSTF)	Airport/Commuter Rail Connection
Subregion (SWAP)	I-495 Transit Authority
Subregion (SWAP)	Logan Express Service
Woburn	Maintain Mishawum Station
Worcester	Move Freight Services from Logan

[1] This listing does not include projects from the Base Case or No-Build Scenario, projects that would not normally be included in a regional transportation model, or projects that are included on the previous pages.

[2] The vast majority of these projects have not been analyzed sufficiently to develop a cost estimate.

Universe of Projects for the 2025 Build Scenario[1]

Projects Identified through RTP Planning Efforts[2, 3]

Community	**Project**
Lynnfield, Peabody & Saugus	Route 1 Capacity Improvements
Boston to Revere	Route 1A Capacity Improvements
Acton to Lexington	Route 2 Capacity Improvements
Arlington & Cambridge	Route 2/Route 16 Capacity Improvements
Randolph to Raynham	Route 24 Capacity Improvements
Wellesley to Beverly	Route 128 Capacity Improvements
Boston to Braintree	I-93 Capacity Improvements
Somerville to Woburn	I-93 Capacity Improvements
Canton to Foxborough	I-95 Capacity Improvements
Littleton to Wrentham	I-495 Capacity Improvements

[1] This listing does not include projects from the Base Case or No-Build Scenario, projects that would not normally be included in a regional transportation model, or projects that are included on the previous pages.

[2] The vast majority of these projects have not been analyzed sufficiently to develop a cost estimate.

[3] Although these project descriptions refer to identified highways, the actual alternative selected by the MPO, if any, might be a transit improvement.

Universe of Projects for the 2025 Build Scenario[1]

Projects Included in Comments on the 2001 RTP Update[2]

Highway Projects

Community	**Project**
Braintree	Braintree Split
Braintree	Route 3/Union Street Safety Improvements
Danvers	Access Management for Route 1A/Route 114
Framingham	Route 9/Rte. 126 Interchange
Framingham	Route 9/Temple Street
Gloucester	Gloucester Rotary
MetroWest Region	MetroWest Regional Bike Trail Network
Natick	Route 9/Oak Street Improvements
Newton	New Ramp from I-95 to Riverside Station
Newton	Route 9/Chestnut Street
North Shore	Route 128 Safety Improvements
Norwood	Route 1/Everett Street
Quincy	Burgin Parkway
Regionwide	Bike and Pedestrian Projects
Regionwide	HOV Lanes for buses
Revere to Lynn	Improved Limited Access Highway
Somerville	Depress I-93
Somerville	Extension of Somerville Bike Path (Cedar Street to Lechmere)
Westborough	Route 9/I-495 Interchange *(Outside Boston MPO region)*

Transit Projects

Community	**Project**
Boston	Additional Railroad Trackage at South Station
Boston	Designated Bus Loop on Urban Ring (Roxbury Xing to Wellington)
Boston	Green Line Express Tunnel under Boston Common
Boston	Landside Water Ferry Connections
Boston	New Ferry Service (Assembly Square to WTC)
Boston	Service Improvements and Shorter Headways (Red Line)
Boston to Canton	Third Railroad Track (Readville to Canton Junction)
Framingham	Helipad at Shoppers' World
Gloucester to Boston	New Ferry Service
Lynn to Boston	Light Rail on Saugus Branch
Lynn to Salem	Blue Line Extention
Marlborough to Fitchburg	Commuter Rail Extension
Medford	Interceptor Station for Medford Hillside
Medford to Somerville	Connect Medford Hillside to Davis Square
North Shore	Connection between Commuter Rail and Orange Line
North Shore	Connection between Commuter Rail and Airport
North Shore	Improved North Shore Commuter Rail Service
North Shore	North Shore Connection to Urban Ring

[1] This listing does not include projects from the Base Case or No-Build Scenario, projects that would not normally be included in a regional transportation model, or projects that are included on the previous pages.

[2] The vast majority of these projects have not been analyzed sufficiently to develop a cost estimate.

Universe of Projects for the 2025 Build Scenario[1]

Projects Included in Comments on the 2001 RTP Update[2]

Transit Projects (cont.)

Community	Project
Providence to Boston	Electrification and Service Improvements on Attleboro Commuter Rail
Regionwide	100 Additional Buses
Regionwide	Additional Transit & Commuter Rail Parking
Regionwide	Commuter Rail Trainset Upgrades to DMU's
Regionwide	Improvements and New Bus Routes
Regionwide	Regional Airport Outside of Route 128
Regionwide	Transit/Car Rental Linkage
Salem and Somerville	New Commuter Rail Stations
Scituate to Marshfield	Extend Greenbush Commuter Rail
Somerville	Union Square Green Line
South Shore	Shuttle Buses to S. Weymouth
South Shore	Bus Service on the South Shore
Worcester to Boston	Improved Commuter Rail Service

[1] This listing does not include projects from the Base Case or No-Build Scenario, projects that would not normally be included in a regional transportation model, or projects that are included on the previous pages.

[2] The vast majority of these projects have not been analyzed sufficiently to develop a cost estimate.

APPENDIX C

TYING POLICIES TO PROJECTS

A matrix was created to help define the relationship between policies and projects. Each project included in the Universe of Projects was rated on its impact to ten of the twelve policies. The two policies not rated (public involvement, Policy 9 and innovative financing, Policy 12) are not applicable to this exercise. The rating system used in the matrix included one of three symbols: a plus sign (+) meant that the project had a positive impact on the policy in question, a zero (0) meant the project was neutral, and a minus sign (-) meant that the project had a negative impact on the policy. The following criteria were used as a guideline for the development of the matrix, subject to interpretation or adjustment based upon professional judgment.

Policy 1: Promote land use policies

Projects located within or providing access to a transportation analysis zone (TAZ) with a combined population and employment per square mile of more than 8,000 persons or located within or providing access to a Concentrated Development Center (CDC) as defined by MetroPlan received a plus (+) rating. Projects providing access to a TAZ with a combined population and employment per square mile of less than 3,000 persons received a minus (-) rating.

Policy 2: Improve safety

Projects that clearly have a large safety component or that are undertaken primarily to address a safety need received a plus (+). Examples of such components include grade separations, haul roads, and certain interchange improvements.

Policy 3: Improve mobility

Projects that provided an additional mode choice or that increased roadway capacity received a plus (+), except in the few cases where capacity would be added to allow for future development and no other defined need currently exists. The only project that is estimated to have a negative impact on mobility involves the reduction of travel lanes from 10 lanes to five.

Policy 4: Minimize pollution

Projects that add a mode choice, address a current operational deficiency, or reduce or segregate truck traffic received a plus (+).

Policy 5: Improve connections among modes

Projects that promoted a multi-modal connection or provided an additional mode choice received a plus (+).

Policy 6: Accessible system to all

Projects that provided ADA accessibility received a plus (+). Projects received a minus

(-) if their use was restricted to a certain subset of users.

Policy 7: Sharing of Benefits/ Burdens

Most of the projects in the Universe of Projects were rated as neutral (0), since this policy seems to be primarily intended to guide a systematic analysis. Exceptions to this rule were projects that are clearly aimed at addressing a long-standing inequity, which received a plus (+).

Policy 8: Preserve and modernize the system

Projects that improved existing infrastructure were given a plus (+). Examples of such improvements include projects that address a gap in the current system, projects that improve existing infrastructure, projects that upgrade transit service, and projects that facilitate the movement of freight. One project received a minus (-) because it significantly reduces currently available travel lanes on the current system.

Policy 9: Promote Public Involvement

Not applicable

Policy 10: Strengthen economic opportunities

Projects that received a plus (+) included those that facilitate the movement of freight between major termini, are clearly tied to an ongoing or planned economic development project, or could spur economic development of an area.

Policy 11: Preserve community character and resources

Projects were ranked under this policy based almost exclusively on professional judgment, taking into account the scope of the proposed project and knowledge of the affected area. As such, the rating for this policy is highly subjective.

Policy 12: Efficient and effective use of financial resources

Not applicable

Relationship of Policies to Projects Included in the Model Scenarios and Universe for the 2000-2025 RTP

+ = postive
o = neutral
- = negative
√ = included in scenario

Project Name Projects with Defined Descriptions and Costs *Highway Projects*	Cost	Current Regional Transportation Plan	2025 Build Alternative 1	2025 Build Alternative 2	2025 Build Alternative 3	Projects with Additional Data Available	Final Network for Public Review	Policy 1 - Support Land Uses	Policy 2 - Safety and Security	Policy 3 - Improve Mobility	Policy 4 - Minimize Pollution/Conserve Energy	Policy 5 - Improve Connections Among Modes	Policy 6 - Accessible System to All	Policy 7 - Sharing of Benefits/Burdens	Policy 8 - Preservation/Modernization of System	Policy 9 - Promote Public Involvement	Policy 10 - Strengthen Economic Opportunities	Policy 11 - Preserve Community Resources/Character	Policy 12 - Efficient/Effective Financial Resources
Bedford , Crosby Drive	$3,500,000	√	√		√	*	√	o	o	+	o	o	o	o	+	N/A	o	o	N/A
Bedford & Burlington , Middlesex Turnpike	$9,000,000	√	√		√	*	√	o	o	+	o	o	o	o	+		o	o	
Boston , Back Bay Turnpike Exit	$100,000,000				√	*		+	o	+	+	o	o	o	+		+	o	
Boston , East Boston Haul Road	$12,000,000		√	√	√		√	+	+	+	+	+	-	+	+		+	+	
Boston , Route 1A/Boardman Street Grade Separation	$8,500,000		√	√	√	*	√	+	+	+	+	o	o	+	+		o	o	
Boston , Rutherford Avenue	$50,000,000		√	√		*	√	+	+	-	o	o	o	+	o		o	+	
Boston & Chelsea , Route 1A/Chelsea Street Bridge Connection	$34,800,000		√	√	√	*		+	o	+	o	o	o	o	+		o	o	
Boston to Newton , Double Stack Initiative	$40,000,000		√	√			√	+	o	+	+	+	-	o	+		+	-	
Cambridge , Cambridgeport Roadways	$3,000,000	√	√	√	√		√	+	o	+	o	o	o	o	+		o	+	
Cambridge , Massachusetts Avenue/Lafayette Square	$4,400,000	√	√	√	√		√	+	o	+	o	o	o	o	o		o	+	
Canton , East/West Connector Road	$7,200,000					*		o	o	+	o	o	o	o	o		+	+	
Canton , I-93/I-95 Interchange	$27,500,000		√		√	*	√	o	+	+	+	o	o	o	+		o	o	
Canton , I-95 (NB)/Dedham Street Ramp	$3,000,000		√		√	*	√	o	o	+	o	+	o	o	+		o	o	
Canton , I-95 (SB)/Dedham Street Onramp	$1,200,000	√	√	√	√	*	√	o	o	+	o	+	o	o	+		o	o	
Concord , Concord Rotary	$35,000,000		√		√	*	√	o	+	+	o	o	o	o	+		o	-	
Concord and Lincoln , Route 2/Crosby's Corner	$17,500,000	√	√		√	*	√	o	+	+	+	o	o	o	+		o	-	
Danvers & Peabody , Route 1/114 Corridor Improvements	$40,000,000		√		√	*	√	o	+	+	o	o	o	o	+	N/A	o	o	N/A
Everett, Malden & Medford , Telecom City Roadways	$24,900,000	√	√	√	√	*	√	+	o	o	o	o	o	-	o		+	+	

Relationship of Policies to Projects Included in the Model Scenarios and Universe for the 2000-2025 RTP

+ = postive
o = neutral
- = negative
√ = included in scenario

Project Name **Projects with Defined Descriptions and Costs** ***Highway Projects (cont.)***	**Cost**	**Current Regional Transportation Plan**	**2025 Build Alternative 1**	**2025 Build Alternative 2**	**2025 Build Alternative 3**	**Projects with Additional Data Available**	**Final Network for Public Review**	**Policy 1 - Support Land Uses**	**Policy 2 - Safety and Security**	**Policy 3 - Improve Mobility**	**Policy 4 - Minimize Pollution/Conserve Energy**	**Policy 5 - Improve Connections Among Modes**	**Policy 6 - Accessible System to All**	**Policy 7 - Sharing of Benefits/Burdens**	**Policy 8 - Preservation/Modernization of System**	**Policy 9 - Promote Public Involvement**	**Policy 10 - Strengthen Economic Opportunities**	**Policy 11 - Preserve Community Resources/Character**	**Policy 12 - Efficient/Effective Financial Resources**
Everett & Medford , Revere Beach Parkway	$54,000,000		√	√	√		√	+	o	+	o	o	o	o	+		o	o	
Framingham , Route 126/135 Grade Separation	$50,000,000		√	√		*	√	+	+	o	+	+	o	o	+		o	+	
Framingham to Worcester , Double Stack Initiative	$16,000,000		√	√	√		√	+	o	+	+	+	-	o	+		+	-	
Franklin , Route 140	$18,000,000	√	√	√	√	*	√	+	o	+	o	o	o	o	+		+	-	
Hanover , Route 53	$4,000,000	√	√		√	*	√	-	o	+	o	o	o	o	+		+	-	
Hingham and Norwell , Route 53/228	$2,500,000		√		√	*	√	-	o	+	o	o	o	o	+		+	o	
Hopkinton , I-495/South Street New Interchange	$20,000,000		√			*		-	o	+	o	o	o	o	o		+	-	
Littleton , Route 2 Interchange	$10,000,000		√					o	o	+	+	+	o	o	o		o	-	
Malden & Revere , Route 1 Improvements	$33,600,000		√		√	*	√	+	+	+	o	o	o	o	+		o	o	
Marlborough , Boundary St./Goddard Rd. Connection	$2,500,000							o	o	+	o	o	o	o	o		o	-	
Marlborough , I-495/I-290/Route 85 Interchange	$25,000,000		√		√	*	√	o	+	+	+	o	o	o	+		o	o	
Marlborough , Route 20, Segments 2&3	$7,200,000	√	√	√	√		√	+	o	+	o	o	o	o	+		o	o	
Natick & Wellesley , Double Stack Initiative	$40,000,000		√	√			√	+	o	+	+	+	-	o	+		+	-	
Newton & Needham , Needham Street/Highland Avenue	$6,600,000	√	√	√	√	*	√	+	o	+	o	o	o	o	o		o	o	
Quincy , Quincy Center Concourse, Phase 2	$6,000,000		√	√	√		√	+	+	+	o	o	o	o	o		o	+	
Randolph to Wellesley , Route 128 Additional Lanes	$97,000,000	√	√		√	*	√	o	o	+	o	o	o	o	+	N/A	o	o	N/A
Reading & Woburn , I-93/I-95 Interchange	$75,000,000		√		√	*	√	o	+	+	+	o	o	o	+		o	o	
Revere , Mahoney Circle Grade Separation	$25,000,000		√	√	√	*	√	+	+	+	+	o	o	o	+		o	o	
Revere , Route 1/Route 16 Interchange	$3,900,000		√	√	√	*	√	+	+	+	+	o	o	o	+		o	o	

Relationship of Policies to Projects Included in the Model Scenarios and Universe for the 2000-2025 RTP

+ = postive
o = neutral
- = negative
√ = included in scenario

Project Name Projects with Defined Descriptions and Costs *Highway Projects (cont.)*	Cost	Current Regional Transportation Plan	2025 Build Alternative 1	2025 Build Alternative 2	2025 Build Alternative 3	Projects with Additional Data Available	Final Network for Public Review	Policy 1 - Support Land Uses	Policy 2 - Safety and Security	Policy 3 - Improve Mobility	Policy 4 - Minimize Pollution/Conserve Energy	Policy 5 - Improve Connections Among Modes	Policy 6 - Accessible System to All	Policy 7 - Sharing of Benefits/Burdens	Policy 8 - Preservation/Modernization of System	Policy 9 - Promote Public Involvement	Policy 10 - Strengthen Economic Opportunities	Policy 11 - Preserve Community Resources/Character	Policy 12 - Efficient/Effective Financial Resources
Revere , Route 1A/Route 16 Connection	$39,600,000		√	√	√	*	√	+	+	+	+	o	o	o	+		o	o	
Salem , Boston Street	$2,000,000		√	√	√		√	+	+	+	o	o	o	o	o		o	o	
Salem , Bridge Street Bypass	$12,300,000	√	√	√	√	*	√	+	+	+	+	o	o	o	+		o	o	
Salem , Bridge Street	$3,000,000		√	√	√	*	√	+	+	+	+	o	o	o	+		o	+	
Salem , Commercial St./Tremont St.	$500,000							+	o	+	o	o	o	o	o		+	o	
Salem , Essex St. Conversion	$2,000,000							o	o	o	-	o	o	o	o		o	-	
Somerville , I-93/Mystic Avenue Interchange	$50,000,000		√	√	√	*		+	+	+	+	o	o	o	+		o	o	
Weymouth , Naval Air Station Access Improvements	$87,500,000		√		√		√	o	o	o	o	o	o	o	o		+	o	
Weymouth , Route 18	$15,000,000		√		√	*	√	o	o	+	o	o	o	o	+		o	-	
Weymouth to Duxbury , Route 3 South Additional Lanes	$180,000,000		√		√	*	√	o	o	+	o	o	o	o	+		+	o	
Wilmington , I-93/Ballardvale Street Interchange	$15,000,000		√		√	*	√	-	+	+	+	o	o	o	+		o	o	
Wilmington , I-93/Route 129 Interchange	$15,000,000		√		√		√	o	+	+	+	o	o	o	+		o	o	
Woburn , New Boston Street Bridge	$2,000,000				√	*	√	o	o	+	o	o	o	o	+		+	o	
Projects with Descriptions and Costs Where Available																			
Highway Projects																			
Acton to Lexington , Route 2 Capacity Improvements								-	+	+	o	o	o	o	+	N/A	+	-	N/A
Arlington & Cambridge , Route 2/Route 16 Interchange								+	+	+	o	o	o	o	+		o	o	
Bedford , Wiggins Avenue Extension								o	o	+	o	o	o	o	o		+	o	

Relationship of Policies to Projects Included in the Model Scenarios and Universe for the 2000-2025 RTP

+ = postive
o = neutral
- = negative
√ = included in scenario

Project Name Projects with Descriptions and Costs Where Available *Highway Projects (cont.)*	Cost	Current Regional Transportation Plan	2025 Build Alternative 1	2025 Build Alternative 2	2025 Build Alternative 3	Projects with Additional Data Available	Final Network for Public Review	Policy 1 - Support Land Uses	Policy 2 - Safety and Security	Policy 3 - Improve Mobility	Policy 4 - Minimize Pollution/Conserve Energy	Policy 5 - Improve Connections Among Modes	Policy 6 - Accessible System to All	Policy 7 - Sharing of Benefits/Burdens	Policy 8 - Preservation/Modernization of System	Policy 9 - Promote Public Involvement	Policy 10 - Strengthen Economic Opportunities	Policy 11 - Preserve Community Resources/Character	Policy 12 - Efficient/Effective Financial Resources
Beverly to Peabody , Route 128 Capacity Improvements	$60,000,000				√	*	√	o	o	+	o	o	o	o	o		o	o	
Boston to Braintree , I-93 Capacity Improvements								+	o	+	o	o	o	-	o		o	-	
Braintree , Route 3/Union Street Safety Improvements [Town of Braintree]								+	+	+	o	+	o	o	o		o	o	
Canton to Foxborough , I-95 Capacity Improvements								-	o	+	o	o	o	o	o		+	o	
Framingham , Rte. 9/Rte. 126 Interchange [Framingham 11/05/01]	$15,000,000				√	*	√	+	+	+	o	o	o	o	+		o	o	
Framingham, Route 9/Temple Street [TPPC]								o	+	+	o	o	o	o	+		o	o	
Gloucester , Gloucester Rotary [NSTF sub-region]								+	+	+	o	o	o	o	o		o	o	
Hudson , Washington St. Widening								o	o	+	o	o	o	o	o		o	o	
Littleton to Wrentham , I-495 Capacity Improvements								-	o	+	o	o	o	o	o		+	-	
Lynnfield to Reading , Route 128 Capacity Improvements	$50,000,000				√	*	√	o	o	+	o	o	o	o	o		o	o	
Lynnfield to Saugus , Route 1 Capacity Improvements								o	+	+	o	o	o	o	+		o	o	
MetroWest Region , MetroWest Regional Bike Trail Network [MetroWest GM Comm.]								+	o	+	o	+	o	o	+		o	+	
Natick, Route 9/Oak Street Improvements [TPPC]								o	+	+	o	o	o	o	+		o	o	
Newton, New Ramp from I-95 to Riverside Station [TPPC]								+	o	+	o	+	o	o	+		o	o	
Newton, Route 9/Chestnut Street [TPPC]								+	+	+	o	o	o	o	o	N/A	o	o	N/A
Norwood , Route 1/Everett Street [TRIC sub-region]								o	o	+	o	o	o	o	+		o	o	
North Shore , Route 128 Safety Improvements [NSTF sub-region]								o	+	+	o	o	o	o	o		o	o	
Quincy , Burgin Parkway	$18,000,000				√	*	√	+	+	+	o	o	o	o	o		+	o	
Randolph to Raynham , Route 24 Capacity Improvements								-	o	+	o	o	o	o	o		+	o	

Relationship of Policies to Projects Included in the Model Scenarios and Universe for the 2000-2025 RTP

+ = postive
o = neutral
- = negative
√ = included in scenario

Project Name Projects with Descriptions and Costs Where Available *Highway Projects (cont.)*	Cost	Current Regional Transportation Plan	2025 Build Alternative 1	2025 Build Alternative 2	2025 Build Alternative 3	Projects with Additional Data Available	Final Network for Public Review	Policy 1 - Support Land Uses	Policy 2 - Safety and Security	Policy 3 - Improve Mobility	Policy 4 - Minimize Pollution/Conserve Energy	Policy 5 - Improve Connections Among Modes	Policy 6 - Accessible System to All	Policy 7 - Sharing of Benefits/Burdens	Policy 8 - Preservation/Modernization of System	Policy 9 - Promote Public Involvement	Policy 10 - Strengthen Economic Opportunities	Policy 11 - Preserve Community Resources/Character	Policy 12 - Efficient/Effective Financial Resources
Regionwide , Bike and Pedestrian Projects [Individuals]								+	o	+	o	+	o	o	o		o	+	
Regionwide , HOV Lanes for buses [Individual]								+	o	+	+	+	o	o	+		o	o	
Revere to Lynn , Improved Limited Access Highway [Everett Public Meeting]								+	o	+	o	o	o	+	o		+	-	
Somerville , Depress I-93 [Everett 11/13/01]								+	+	+	o	o	o	+	o		+	+	
Somerville to Woburn , I-93 Capacity Improvements								+	o	+	o	o	o	o	o		o	-	
Somerville , Extension of Somerville Bike Path (Cedar Street to Lechmere) [Everett Public Meeting]								+	o	+	o	+	o	o	+		o	+	
Wellesley to Woburn , Route 128 Capacity Improvements								o	o	+	o	o	o	o	o		o	o	
Projects Not Defined by Staff																			
Highway Projects																			
Ashland , Route 135 Grade Separations	Not sufficiently defined for staff to craft a definition or cost estimate																		
Arlington/Cambridge , Route 2/Route 16 Capacity Improvements	Duplicate--See Arlington & Cambridge, Route 2/Route 16 Interchange																		
Boston , Central Artery/Highway Connections	Not sufficiently defined for staff to craft a definition or cost estimate																		
Boston , Extend the I-93 HOV Lane into the City	Not sufficiently defined for staff to craft a definition or cost estimate																		
Boston , Fenway Park Highway Improvements	Legislatively created project that is currently inactive																		
Boston to Revere , Route 1A Capacity Improvements	Duplicate--See, the various improvements from the Lower North Shore Traffic Study																		
Braintree , Braintree Split [Braintree 11/08/01, RTAC, etc.]	Project scope is so large that it cannot be defined in the timeframe provided for RTP development.																		
Burlington , Route 3A	As currently scoped, this project is not regionally significant																		
Danvers , Access Management for Route 1A/Route 114 [NSTF sr]	Not sufficiently defined for staff to craft a definition or cost estimate																		

Relationship of Policies to Projects Included in the Model Scenarios and Universe for the 2000-2025 RTP

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Project Name **Projects Not Defined by Staff** ***Highway Projects (cont.)***	**Cost**	**Current Regional Transportation Plan**	**2025 Build Alternative 1**	**2025 Build Alternative 2**	**2025 Build Alternative 3**	**Projects with Additional Data Available**	**Final Network for Public Review**	**Policy 1 - Support Land Uses**	**Policy 2 - Safety and Security**	**Policy 3 - Improve Mobility**	**Policy 4 - Minimize Pollution/Conserve Energy**	**Policy 5 - Improve Connections Among Modes**	**Policy 6 - Accessible System to All**	**Policy 7 - Sharing of Benefits/Burdens**	**Policy 8 - Preservation/Modernization of System**	**Policy 9 - Promote Public Involvement**	**Policy 10 - Strengthen Economic Opportunities**	**Policy 11 - Preserve Community Resources/Character**	**Policy 12 - Efficient/Effective Financial Resources**
Hingham/Norwell, Queen Anne's Cnr Channel. [Braintree 11/08/01]	Duplicate--See, the Route 53/228 project (Hingham and Norwell)																		
MAGIC subregion , Highway Mobility on State Routes	Not sufficiently defined for staff to craft a definition or cost estimate																		
MetroWest subregion , Improvements to Arterial Highways	Not sufficiently defined for staff to craft a definition or cost estimate																		
MetroWest subregion , New Turnpike Interchanges	Not sufficiently defined for staff to craft a definition or cost estimate																		
Regionwide , Highway Industrial Park Access	Not sufficiently defined for staff to craft a definition or cost estimate																		
Regionwide , ITS Roadway Projects	Not sufficiently defined and not regionally significant																		
Regionwide , Modern Traffic Rotaries	Not sufficiently defined and not regionally significant																		
Regionwide , Pedestrian Improvements	Not sufficiently defined and not regionally significant																		
Sherborn , Route 16/Route 27 Improvements	Not sufficiently defined for staff to craft a definition or cost estimate																		
Westborough , Rte. 9/I-495 Interchange [Framingham 11/05/01]	Outside of the MPO Region in Westborough, MA																		
Projects with Defined Descriptions and Costs																			
Transit Projects																			
Boston , Arborway Green Line	$59,000,000	√	√	√	√	*	√	+	o	+	+	+	+	o	o	N/A	o	+	N/A
Boston , Fairmount Branch Improvements	$29,600,000		√	√	√	*	√	+	o	+	+	+	+	+	+		+	+	
Boston , Light Rail Service on Washington Street	$165,000,000				√	*		+	o	+	+	+	+	+	o		+	o	
Boston , North/South Rail Link	TBD					*		+	o	+	+	+	+	o	+		o	o	
Boston , Red-Blue Connector	$220,000,000	√	√	√	√	*	√	+	o	+	o	+	+	o	+		o	o	
Boston , Russia Wharf Ferry Terminal	$5,000,000	√	√	√	√		√	+	o	+	o	+	+	o	o		o	+	

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Project Name Projects with Defined Descriptions and Costs *Transit Projects (cont.)*	Cost	Current Regional Transportation Plan	2025 Build Alternative 1	2025 Build Alternative 2	2025 Build Alternative 3	Projects with Additional Data Available	Final Network for Public Review	Policy 1 - Support Land Uses	Policy 2 - Safety and Security	Policy 3 - Improve Mobility	Policy 4 - Minimize Pollution/Conserve Energy	Policy 5 - Improve Connections Among Modes	Policy 6 - Accessible System to All	Policy 7 - Sharing of Benefits/Burdens	Policy 8 - Preservation/Modernization of System	Policy 9 - Promote Public Involvement	Policy 10 - Strengthen Economic Opportunities	Policy 11 - Preserve Community Resources/Character	Policy 12 - Efficient/Effective Financial Resources
Boston , Silver Line, Phase 3	$713,000,000	√	√	√	√	*	√	+	o	+	+	+	+	o	o		+	+	
Braintree to Scituate , Greenbush Commuter Rail	$400,000,000	√	√	√	√	*	√	-	o	+	+	+	+	o	+		+	-	
Cambridge to Medford , Medford Hillside Green Line	$375,000,000	√	√	√	√	*	√	+	o	+	+	+	+	+	+		o	+	
Framingham to Marlborough , Commuter Rail Extension	$159,000,000					*		o	o	+	+	+	+	o	+		o	o	
Inner Core , Urban Ring, Phase 1	$100,000,000		√	√		*	√	+	o	+	+	+	+	+	o		+	+	
Inner Core , Urban Ring, Phase 2	$500,000,000			√		*		+	o	+	+	+	+	+	o		+	+	
Inner Core , Urban Ring, Phase 3	$2,000,000,000					*		+	o	+	+	+	+	+	+		+	+	
Littleton , New Commuter Rail Station	$4,000,000		√			*		-	o	+	+	+	o	o	o		o	o	
Needham to Millis , Commuter Rail Extension	$10,600,000					*		-	o	+	+	+	+	o	+		+	o	
Regionwide , Planned Transit & Commuter Rail Parking	$215,000,000			√	√		√	o	o	+	+	+	o	-	+		o	o	
Revere , Airport/Commuter Rail Connection	$78,000,000					*		+	o	+	+	+	+	o	o		o	o	
Revere to Lynn , Blue Line Extension	$292,000,000					*		+	o	+	+	+	+	o	o	N/A	+	+	N/A
Somerville , Assembly Square Orange Line Station	$5,000,000			√	√		√	+	o	o	+	+	+	+	o		+	+	
Stoughton to New Bedford , New Bedford /Fall River Commuter Rail	$610,000,000		√		√	*	√	o	o	+	+	+	+	+	+		+	-	
Projects with Descriptions and Costs Where Available																			
Transit Projects																			
Ashland, Southborough & Westborough , Rail Link Shuttle Service [MetroWest GM Comm.]								-	o	+	+	+	o	o	+	N/A	+	+	N/A
Boston , Additional Railroad Trackage at South Station [Newton Public Meeting]								+	o	+	+	+	+	o	+		o	+	

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Project Name Projects with Descriptions and Costs Where Available *Transit Projects (cont.)*	Cost	Current Regional Transportation Plan	2025 Build Alternative 1	2025 Build Alternative 2	2025 Build Alternative 3	Projects with Additional Data Available	Final Network for Public Review	Policy 1 - Support Land Uses	Policy 2 - Safety and Security	Policy 3 - Improve Mobility	Policy 4 - Minimize Pollution/Conserve Energy	Policy 5 - Improve Connections Among Modes	Policy 6 - Accessible System to All	Policy 7 - Sharing of Benefits/Burdens	Policy 8 - Preservation/Modernization of System	Policy 9 - Promote Public Involvement	Policy 10 - Strengthen Economic Opportunities	Policy 11 - Preserve Community Resources/Character	Policy 12 - Efficient/Effective Financial Resources
Boston , Central Artery Fixed Guideway								+	o	+	o	+	+	o	o		o	o	
Boston , Designated Bus Loop on Urban Ring (Roxbury Xing to Wellington) [Individual]								+	o	+	+	+	+	+	o		+	-	
Boston , East/West Rail Link								+	o	+	+	+	+	o	o		+	o	
Boston , Extension of Silver Line to Mattapan								+	o	+	o	+	+	+	o		+	o	
Boston , Green Line Express Tunnel under Boston Common [Everett 11/13/01]								+	o	+	o	o	o	o	o		o	o	
Boston , Green Line through Stuart Street Tunnel								+	o	+	o	o	o	-	o		o	o	
Boston , Landside Water Ferry Connections [Individuals]								+	o	+	+	+	+	o	+		o	+	
Boston , New Ferry Service (Assembly Square to WTC) [Everett Public Meeting]								+	o	+	o	+	o	o	+		+	+	
Boston , Rapid Transit to South Boston								+	o	+	o	o	+	-	+		+	-	
Boston , Red Line to Massachusetts Avenue								+	o	+	+	+	+	+	o	N/A	o	+	N/A
Boston , Service Improvements and Shorter Headways (Red Line) [Boston Public Meeting, Individual]								+	o	+	o	o	o	o	+		o	o	
Boston to Canton , Third Railroad Track (Readville to Canton Junction) [Newton Public Meeting]								o	o	+	+	o	o	o	+		o	-	
Boston to Foxborough , Regular Commuter Rail Service								-	o	+	+	+	o	o	+		+	o	
Boston to Needham , Orange Line Extension to Route 128								+	o	+	+	+	+	-	+		o	-	
Cambridge to Arlington , Red Line Extension to Arlington Center								+	o	+	+	+	+	o	+		o	+	
Cambridge to Bedford , Red Line Extension								o	o	+	+	+	+	o	+		o	-	
Danvers to Boston , Commuter Rail Service								+	o	+	+	+	+	o	+		o	-	
Dedham , Everett Street/Route 1 Underpass [TRIC sub-region]								o	+	+	o	o	o	o	+		o	o	
Fitchburg to Boston , Double Track Commuter Rail								o	o	+	+	+	o	+	+		o	-	

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Project Name Projects with Descriptions and Costs Where Available *Transit Projects (cont.)*	Cost	Current Regional Transportation Plan	2025 Build Alternative 1	2025 Build Alternative 2	2025 Build Alternative 3	Projects with Additional Data Available	Final Network for Public Review	Policy 1 - Support Land Uses	Policy 2 - Safety and Security	Policy 3 - Improve Mobility	Policy 4 - Minimize Pollution/Conserve Energy	Policy 5 - Improve Connections Among Modes	Policy 6 - Accessible System to All	Policy 7 - Sharing of Benefits/Burdens	Policy 8 - Preservation/Modernization of System	Policy 9 - Promote Public Involvement	Policy 10 - Strengthen Economic Opportunities	Policy 11 - Preserve Community Resources/Character	Policy 12 - Efficient/Effective Financial Resources
Framingham , Helipad at Shoppers' World [Framingham 11/05/01]								o	o	+	o	+	o	o	o		o	-	
Gloucester to Boston , New Ferry Service								+	o	o	-	o	+	o	o		o	+	
Lynn to Boston , Light Rail on Saugus Branch[Everett 11/13/01]								+	-	+	+	+	+	+	+		o	-	
Lynn to Boston , Saugus Commuter Rail Service								+	-	+	+	+	+	+	+		o	-	
Lynn to Salem , Blue Line Extention [Salem Public Meeting]								+	o	+	+	+	+	+	+		+	+	
Malden to Reading , Orange Line Extension to Route 128								o	o	+	+	+	+	-	+		o	-	
Marlborough to Fitchburg , Commuter Rail Extension [MetroWest GM Comm.]								-	o	+	+	+	+	o	+		+	o	
Medford , Interceptor Station for Medford Hillside [Everett 11/13/01]								+	o	+	o	+	+	+	+	N/A	o	o	N/A
Medford to Somerville , Connect Medford Hillside to Davis Square [Everett 11/13/01]								+	o	+	+	+	o	o	o		o	o	
Providence to Warwick , Commuter Rail to TF Green Airport								o	o	+	+	+	+	o	+		-	o	
Providence to Boston , Electrification and Service Improvements on Attleboro CR [Individuals]								o	o	+	+	o	o	o	+		o	+	
Regionwide , 100 Additional Buses					√			+	o	+	+	+	+	+	o		o	o	
Regionwide , Additional Transit & Commuter Rail Parking								o	o	+	+	+	o	-	+		o	o	
Regionwide , Commuter Rail Trainset Upgrades to DMU's [Individual]								o	o	o	+	o	+	o	+		o	o	
Regionwide , Improvements and New Bus Routes [Everett, Salem, and Boston Public Meetings]								+	o	+	o	o	o	+	o		o	o	
Salem and Somerville , New Commuter Rail Stations [Salem, Everett Public Meetings]								+	o	+	+	+	+	+	+		o	o	
Scituate to Marshfield , Extend Greenbush CR [Braintree 11/08/01]								-	o	+	+	+	+	o	+		+	-	
Somerville , Union Square Green Line [Everett 11/13/01]								+	o	+	+	o	+	+	+		+	o	
South Shore , Shuttle Buses to S. Weymouth [Braintree 11/08/01]								o	o	+	+	o	o	o	o		o	+	

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Project Name **Projects with Descriptions and Costs Where Available** ***Transit Projects (cont.)***	**Cost**	**Current Regional Transportation Plan**	**2025 Build Alternative 1**	**2025 Build Alternative 2**	**2025 Build Alternative 3**	**Projects with Additional Data Available**	**Final Network for Public Review**	**Policy 1 - Support Land Uses**	**Policy 2 - Safety and Security**	**Policy 3 - Improve Mobility**	**Policy 4 - Minimize Pollution/Conserve Energy**	**Policy 5 - Improve Connections Among Modes**	**Policy 6 - Accessible System to All**	**Policy 7 - Sharing of Benefits/Burdens**	**Policy 8 - Preservation/Modernization of System**	**Policy 9 - Promote Public Involvement**	**Policy 10 - Strengthen Economic Opportunities**	**Policy 11 - Preserve Community Resources/Character**	**Policy 12 - Efficient/Effective Financial Resources**
Worcester to Boston , Improved Commuter Rail Service [Everett Public Meeting]								+	o	+	+	+	o	+	+		+	+	
Connection between Commuter Rail and Orange Line [NSTF sub-region]								+	o	+	+	+	+	o	+		o	o	
Connection between Commuter Rail and Airport [NSTF sub-region]								+	o	+	+	+	+	o	+		o	o	
Improved North Shore Commuter Rail Service [NSTF sub-region]								+	o	+	+	o	o	o	+		o	o	
North Shore Connection to Urban Ring [NSTF sub-region]								+	o	+	+	+	+	o	+	N/A	+	o	N/A
Regional Airport Outside of Route 128 [Everett Public Meeting]								-	o	+	o	+	o	+	o		+	-	
Transit/Car Rental Linkage [Individual]								+	o	+	o	+	o	o	+		o	o	

Projects Not Defined by Staff ***Transit Projects***	
Boston , Expanded Bus Service	Not sufficiently defined for staff to craft a definition or cost estimate
Boston , Full use of Yawkey Station	This suggestion has already been implemented
Boston , Operational Improvements to Subways	Not sufficiently defined for staff to craft a definition or cost estimate
Boston , Rail Shuttle from Yawkey to South Boston	Duplicate - See East/West Rail Link
Boston , Red-Blue Pedestrian Connection	MBTA initiative under the 1997 RTP that is currently inactive
Boston , Transit Improvements for EJ Communities	Not sufficiently defined for staff to craft a definition or cost estimate
Boston , Yawkey Station Upgrade	Legislatively created project that is currently inactive
Boston to Worcester , New Bus Service on Route 9	Not sufficiently defined and not regionally significant

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MetroWest Subregion , Transit Service on Route 20	Not sufficiently defined for staff to craft a definition or cost estimate																		
Regionwide , Additional Capacity on Commuter Rail	Not sufficiently defined for staff to craft a definition or cost estimate																		
Regionwide , Bicycle Facilities	Not sufficiently defined and not regionally significant																		
Regionwide , Circumferential Transit outside the Core	Not sufficiently defined for staff to craft a definition or cost estimate																		
Regionwide , Commuter Rail Extensions	Not sufficiently defined for staff to craft a definition or cost estimate																		
Regionwide , Commuter Rail Frequency Improvements	Not sufficiently defined for staff to craft a definition or cost estimate																		
Regionwide , Expansion of Carpool/Vanpool Parking	Not sufficiently defined for staff to craft a definition or cost estimate																		
Regionwide , Increased TMA/TDM Programs	Not sufficiently defined for staff to craft a definition or cost estimate																		
Regionwide , Increases to the Inter-District Program	Not sufficiently defined for staff to craft a definition or cost estimate																		
Regionwide , ITS Transit Projects	Not sufficiently defined and not regionally significant																		
Regionwide , New "Infill" Stations on Transit Routes	Not sufficiently defined for staff to craft a definition or cost estimate																		
Regionwide , New and Improved Ferry Service	Not sufficiently defined for staff to craft a definition or cost estimate																		
Regionwide , New Busways, but not on Washington Street	Not sufficiently defined for staff to craft a definition or cost estimate																		
Regionwide , Reverse Commute on Commuter Rail	Not sufficiently defined for staff to craft a definition or cost estimate																		
Regionwide , Suburb-to-Suburb Transit Service	Not sufficiently defined for staff to craft a definition or cost estimate																		
Regionwide , Shuttle Bus/Commuter Rail Connections	Not sufficiently defined for staff to craft a definition or cost estimate																		
Regionwide , Transit Frequency Improvements	Not sufficiently defined for staff to craft a definition or cost estimate																		
Regionwide , Use of Road-Railers	Not sufficiently defined for staff to craft a definition or cost estimate																		
South Shore , Bus Service on the South Shore [Braintree 11/08/01]	Not sufficiently defined for staff to craft a definition or cost estimate																		

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Project Name **Projects Not Defined by Staff** ***Transit Projects (cont.)***	**Cost**	**Current Regional Transportation Plan**	**2025 Build Alternative 1**	**2025 Build Alternative 2**	**2025 Build Alternative 3**	**Projects with Additional Data Available**	**Final Network for Public Review**	**Policy 1 - Support Land Uses**	**Policy 2 - Safety and Security**	**Policy 3 - Improve Mobility**	**Policy 4 - Minimize Pollution/Conserve Energy**	**Policy 5 - Improve Connections Among Modes**	**Policy 6 - Accessible System to All**	**Policy 7 - Sharing of Benefits/Burdens**	**Policy 8 - Preservation/Modernization of System**	**Policy 9 - Promote Public Involvement**	**Policy 10 - Strengthen Economic Opportunities**	**Policy 11 - Preserve Community Resources/Character**	**Policy 12 - Efficient/Effective Financial Resources**
Stoughton to Easton , Commuter Rail Extension	Duplicate--See Fall River/New Bedford CR Extension																		
SWAP Subregion , I-495 Transit Authority	Not sufficiently defined for staff to craft a definition or cost estimate																		
SWAP Subregion , Logan Express Service	Not sufficiently defined for staff to craft a definition or cost estimate																		
Weston , Masspike/Rte. 128 Station	MBTA initiative under the 1997 RTP that is currently inactive																		
Woburn , Maintain Mishawum Station	Operational with MBTA, not MPO decision																		
Worcester , Move freight services from Logan	Not viable																		

APPENDIX D

MODELING INFORMATION ON ALTERNATIVES ANALYZED DURING THE PLAN UPDATE PROCESS

To respond to the Transportation Planning and Programming Committee (TPPC), CTPS staff looked at a variety of sources of information on projects planned throughout the Metropolitan Boston region, selected what was deemed to be the best or most appropriate, and combined it in this appendix. In addition to the RTP travel model runs, Environmental Impact Reports and other kinds of alternatives analyses done by CTPS and others were consulted. In the tables that follow, the source of information for each project is listed.

Due to the disparate sources of information, please note that project benefits cannot be compared precisely to one another. The studies consulted were done at various points in time, used modeling and other assumptions that may differ from those used in other studies, or may have used different horizon years. Despite these differences, the information, if viewed broadly, can provide some insight into the probable benefits associated with projects.

The remainder of the memo contains six tables, each of which will be briefly discussed in turn. The first two pertain to project-specific benefits. Table D-1 covers roadway-related projects and Table D-2 covers transit projects. Tables D-3, D-4, D-5, and D-6 contain travel model information associated with the different network and land use scenarios modeled, but not necessarily with specific projects. Alternatives 1, 2, and 3 model runs were performed with the Basic Forecast land use assumptions, while Alternatives 1 and 2 were run with the Targeted Growth land use assumptions. The final build scenario model run was performed with the Targeted Growth land use assumptions as recommended by the TPPC.

Table D-1: Project-level Information for Roadway Projects

Two different sources, as noted in the table, were used for the information in this table that discusses roadway project benefits. The first source is the regional travel model; it was used to estimate the probable changes in volume-to-capacity ratios for major highways. The changes noted are generalized from

the different network/land use scenarios modeled. In most cases, the change in volume-to-capacity was similar across build alternatives.

As is evident, and as was expected in the vast majority of cases, the build volume-to-capacity ratio is less than that for the no-build case. The lower the volume-to-capacity ratio, the less the projected congestion. The build ratios are not always significantly less than those for the no-build scenario. This occurs when traffic attracted to the expanded roadway from other nearby roadways prevents the volume-to-capacity ratio from declining much. The benefits to some parallel roadways can be seen in Table D-3.

The second source of information in this table was past EIRs and other alternative analyses. In some cases, quantitative information in the form of Level-of-Service (LOS) is presented. In other cases, the benefits are characterized solely in qualitative terms. In all cases, the benefits are generalized across what are often multiple impacts associated with the project. That is, a project may have been forecast to benefit several intersections. Rather than present a huge quantity of detailed data, the benefits are characterized for the set of intersections as a whole.

Table D-2: Project-level Information for Transit Projects

This table presents available information on benefits for the transit projects contained in the RTP. Most of the information was culled out of previous project-level travel modeling projects done by CTPS. This was done because, in the model runs for the RTP in which groups of projects were modeled together, benefits associated with single projects cannot be isolated. Along with projected ridership, it is customary when describing transit project benefits to include new riders attracted from the non-transit modes, travel time savings, and changes in vehicle-miles traveled relative to the no-build scenario used in that project analysis. All of these measures are included in the table.

Ridership is simply the total daily boardings projected for the project. New riders are those expected to be diverted from the single-occupant, multiple-occupant, and walk travel modes. In the Boston region, these numbers tend to be modest because we have a mature transit system with established rider markets; most users of a new transit service are those who were already using other routes in the transit system. The two projects showing, by far, the greatest numbers of new riders are the Rail Link and the Urban Ring Phase III. These two projects, along with the Silver Line Phase B, are also projected to have the greatest ridership. Projects that attract the largest percent of new riders are commuter rail extensions into areas where there are no other transit services, so riders are diverted from the automobile.

Travel time savings are defined as the total hours saved by all continuing riders. These are riders who are forecast to use transit in both the no-build and build scenarios. This is the total benefit that accrues to them due to the new service saving them time. Given, as noted above, that shifts to the transit mode in this region are often modest, this is an important measure because it is independent of new riders. Phases II and III of the Urban Ring are forecast to have the greatest travel time savings.

The reduction in automobile vehicle miles (one vehicle driven one mile constitutes a vehicle-mile) is measured as the total reduction in the system (in this case, Eastern Massachusetts) forecast for travelers switching from auto modes to the new transit service. This measure is used in subsequent analyses to determine changes in air quality. In the Boston region, this number is usually fairly modest due to the modest mode shifting that occurs, and also because some travelers who switch to transit use park/ride or kiss/ride to access transit; their vehicle miles to and from the transit station are captured in the model results. The New Bedford/Fall River Extension, the Rail Link, and the Urban Ring Phase III are forecast to yield the largest vehicle-mile reductions. This is because travelers diverted from the automobile to these projects tend to be making lengthy trips from outlying communities to the region's core.

In the Urban Ring's case, the vehicle-mile reduction is more a function of the large number of new riders.

Table D-3: Volume-to-Capacity Ratios along Major Highways

The purpose of this table is to provide general impressions about the impacts of network and land use scenarios on an important highway performance measure. Among the highway links shown are those associated with a capacity-enhancing project (also shown in Table D-1), and those not associated with any particular project. Two observations can be made about this table. The first is that the volume-to-capacity ratios tend to decline when moving from the no-build to the build scenarios. The second is that the volume-to-capacity ratios tend not to differ significantly among the build alternatives. Both of these results are expected.

Table D-4: Transit Capacity Analysis

This table helps to illustrate the impacts of the final and other build alternatives on an important measure: passenger volume at the peak load point of a transit line. Some rapid transit/light rail peak loads would increase while others would decrease compared to the no-build alternative. The Blue line peak load would increase moderately due mostly to the ridership generating effect of the Red Line/Blue Line connector. The Green Line East would increase due, in part, to the Medford Hillside Extension, while the Green Line West would increase due, in part, to the Arborway restoration.

The Orange Line South peak load would decline due to the Urban Ring, and perhaps the Arborway Restoration, diverting trips from it. The Red Line South peak load would decline due to diversions to the Greenbush Line and the improved Fairmont Branch. The Red Line North peak load would decline due to diversions to the Medford Hillside extension. Commuter rail peak loads would decline due to diversions to the Urban Ring and other transit projects, and to the highway system, in response to the many improvements contained in that system.

The table also shows the impact that different land use patterns would likely have on transit peak loads. The main effect of the targeted growth scenario would be to increase most of the rapid transit/light rail peak loads and to decrease those on commuter rail compared to the basic forecast land use scenario. This would be due to the targeted growth scenario's greater concentration of households and employment closer to the region's core where rapid transit is a more viable transit option.

Table D-5: Summary of Drive Access Transit Model Results

This table shows parking demand and parking capacity for each network/land use scenario. As can be seen, the demand-to-capacity ratios tend to decline in the Build 1 scenario as compared to the no-build. This is simply because capacity would increase more than demand. In the Build 2 scenario, the ratios decline still further. In this scenario, another 15,000 spaces would be added, but demand only increases by 6,900.

Table D-6: Travel Model Results

Table D-6 depicts summary model results for all alternatives analyzed for the Regional Transportation Plan. An alternative is defined as an assumed transportation network in combination with a land use scenario. The first page of Table D-6 shows the results of the no-build and build networks run with the Basic Forecast land use scenario, while the second page shows the no-build and build networks run on the Targeted Growth land use scenario. The Build 3 and the Final Build networks are different networks and should not be compared to each other.

Comparison of Basic Forecast to Targeted Growth Results

In general, there are larger model differences between the two land use scenarios, for a given network, than there are among the networks run

on a given land use scenario. In other words, land use has a greater impact than transportation investments on most system performance measures.

Some of these differences can be seen in the person trips by mode. There are slightly more (one percent more) total person trips in the system in the Targeted Growth scenario. Moreover, due to the fact that the Targeted Growth scenario, by definition, concentrates more growth closer to the region's core where transit is a more viable option, the networks associated with that scenario show somewhat greater numbers of transit trips (six to eight percent more). The differences are especially noticeable on rapid transit, as might be expected: rapid transit is the backbone of the core area's transit network. The concentration of population and employment also leads to more walk trips than in the same networks run with the Basic Forecast scenario. This is because the greater concentration of population and employment provides more opportunities for accomplishing trips by walking.

The Targeted Growth results for highway vehicle trips also differ slightly from those associated with the Basic Forecast results. There are fewer vehicle trips in the Targeted Growth alternatives (corresponding to there being more transit trips in them), and the concentrated growth also yields a slightly shorter average vehicle trip length due to activities being slightly closer to one another, on average. These two things combine to yield slightly lower vehicle-miles traveled in the Targeted Growth alternatives. In addition, the average vehicle speeds in the Targeted Growth alternatives are the same as or faster than those in the Basic Forecast alternatives due to there being slightly fewer vehicle trips on the roads.

Comparison of Different Networks within a Given Land Use Scenario

The differences among alternative build networks for a given land use scenario tend to be minor. In many cases, the differences are so slight that they cannot be thought of as true differences. Rather, they have to be considered to be within the error range of the modeling process. For example, the Build 1 and Final Build alternatives, run on the Targeted Growth Land use scenario, differ in their numbers of intraregional auto trips by 4,800. This is four-hundredths of one percent, and therefore, cannot be taken as a true difference.

The Final Build alternative yields two percent fewer linked transit trips than the Build 2 alternative. This is primarily because of the greater number of highway projects in the Final Build alternative that compete with transit projects in some parts of the region.

The Final Build alternative yields slightly higher vehicle-miles traveled than the other two build alternatives (two-tenths and four-tenths of a percent). This is because that alternative has slightly more highway vehicle trips and a slightly higher average vehicle trip length. The higher average vehicle trip length results from the particular combination of highway projects in that alternative as compared to the other two alternatives. Some highway projects, when added to the system, will cause some travelers to divert from shorter distance paths to what might be longer distance paths in order to take advantage of greater time savings. Added freeway capacity, for example, will divert some travelers from shorter distance surface street routes to longer distance, but faster, freeway-oriented routes.

TABLE D-1
Project Level Information for Roadway Projects

Project Name	Source	Description of Improvements	Anticipated Benefits
Crosby Drive (Bedford)	Model Data	Crosby Drive in Bedford will have a five-lane cross section with two travel lanes in each direction with a center turn lane for its entire length. The project also includes a slip ramp to Route 3 Northbound.	The v/c on Crosby Drive between Rte. 3 and Middlesex Turnpike improves from 0.29 to 0.22 from the No-build to the Build cases.
Middlesex Turnpike/Crosby Drive (Bedford and Burlington)	Middlesex Turnpike/ Crosby Drive Transportation Improvements Project Volume 1A—DEIR VHB, Inc. March 1997	Crosby Drive in Bedford will have a five-lane cross section with two travel lanes in each direction with a center turn lane for its entire length. The project also includes a slip ramp to Route 3 Northbound.	The Crosby Drive analysis looked at two intersections with existing LOS F and increased their LOS by at least one grade to (D-C) in 2016. These intersections also reduced delay times by almost half.
	Model Data	Middlesex Turnpike will be widened by one travel lane in each direction with a sixteen foot raised median from Route 62 in Bedford to manning Road in Billerica.	Middlesex Turnpike looked at 8 intersections. Of these 8 total, 7 intersections received LOS grades of F. Under the suggested alternative, these intersections increased their LOS by at least one grade (E-B) in 2016. Delay times were also reduced significantly. The v/c on Middlesex Turnpike South of Concord Road in Billerica improves from 1.47 to 1.22. The v/c also improves on Middlesex Turnpike North of Lexington Street in Burlington from 1.19 to 0.96.
I-95 (SB)/Dedham Street On-Ramp, Canton	Design study is complete; project due for construction in spring 2002	Design and construct a SB on-ramp to I-95 from Dedham Street in Westwood. Westbound left turns will not be allowed onto the ramp. Ramp is scheduled for construction in spring 2002.	About 1/3 of the Blue Hill Drive on ramp traffic to Route 128 SB is presently destined for I-95 south. The new on-ramp will improve congestion, queues and delays at the present on-ramp.
	Model Data	This project provides direct access to I-95 south for traffic from the University Avenue development area in Westwood. Present access is through the Route 128 on-ramp at Blue Hill Drive, a very congested area.	The v/c on I-95 south of the I-93 interchange degrades from 1.07 to 1.17 from the No-build to the Build cases.

Table D-1
Project Level Information for Roadway Projects

Project Name	Source	Description of Improvements	Anticipated Benefits
Route 2/Crosby's Corner, Concord and Lincoln	Draft EIR is complete; FEIR under FHWA review	Design and construct a fly-over bridge for the westbound direction of Route 2. Maintain local access by retaining (with improvements) the existing traffic signal at Route 2/2A/Cambridge turnpike Cutoff. Design and construct service roads between, approximately, Bedford Road and the traffic signal to allow for safe and effective local circulation and access. This is primarily a safety improvement but the project will have congestion and access benefits as well.	Significant safety benefits for Route 2/2A/Cambridge Turnpike Cutoff traffic. Improved Route 2 access and safety for Lincoln residents with homes along Route 2 between Bedford Road and the traffic signal.
Route 1/114 Corridor Improvements, Danvers and Peabody	CTPS and VHB planning and feasibility studies from the early and mid 90s Model Data	Design and construct a single-point diamond interchange at Route 114 and Route 1; improve access from Route 114 to I-95. Design and construct traffic management improvements along Route 114. Project will develop direct connections between Route 1, Route 114 and I-95 and improve traffic flow along Route 114.	Allows for direct access to I-95 from Route 1 and Route 114. Promotes safe and effective traffic flow in the area. The v/c on Rte. 114 between Watson Pkwy and the RR bridge improves from 0.70 to 0.52 from the No-build to the Build cases.
Telecom City (Malden, Medford, Everett)	Telecom City Report on Traffic Impacts and Mitigation Strategies Mystic Valley Development Commission November 1998	Reconstruction of Commercial Street at Medford Street in Malden to include new traffic signal equipment serving four 11-foot lanes plus 4-foot outside shoulders. In the southbound direction, the alignment of the existing reverse s-curve will be flattened. Commercial Street will include a northbound and a southbound lane separated by a median, which will be narrowed at several locations to accommodate a protected southbound left turn lane. A new road connects Corporation Way with Santilli Highway.	This project consists of 5 intersections that examine safety and traffic movement. All of the intersections studied showed no change in LOS grading. Some delay times were reduced with the projected implementation of the alternative suggested, however these were not significant enough to raise the intersection up or down a LOS grade. All data was from 2001.

TABLE D-1
Project Level Information for Roadway Projects

Project Name	Source	Description of Improvements	Anticipated Benefits
Route 126/Route 135 Grade Separation (Framingham)	Route 126 Corridor Study Rizzo Associates, Inc. January 1997	Construction of a below-grade underpass (one lane in each direction) on Route 126 beginning on the north at Park Street and on the south near Irving Street. It will pass beneath the MBTA rail crossing and Route 135. Travel lanes will also be maintained at grade at the Route 126/Route 135 intersection with an upgraded signal.	This project examines the major intersection of Rte. 126 and Rte. 135. Existing conditions (1996) showed LOS to be undefinable because v/c ratios and delay times being incalculable. The suggested alternative created calculable delay times showing LOS increasing by at least one grade (E-C) in 2020.
	Model Data		The v/c on Rte. 126 north of Rte. 135 improves from 2.07 to 1.36 from the No-Build to the Build cases. The v/c on Rte. 135 west of Rte. 126 stays the same from the No-Build to the Build cases.
Route 140 (Franklin)	Model Data	Route 140 is to be widened from one lane in each direction to two lanes in each direction from I-495 to Garelick Farms. The alignment of Route140 will also be altered to accommodate an improved diamond interchange. The length of Route 140 affected is 1.2 miles.	The v/c on Rte. 140 North of I-495 improves from 1.26 to 0.86 from the No-Build to the Build cases.
Route 53 (Hanover)	Proposed Route 53 Phase 1B Transportation Improvements Project Volume 1 – DEIR March 1998	Route 53 is widened from Mill Street to Pond Street from the existing 32-foot cross section to a 66-foot cross section with two lanes in each direction and a center turn lane. A 4-way intersection will be realigned to include Pond Street, Route 53 and Washington Street.	The study looked at three major intersections along Route 53. Existing conditions (1996) showed LOS as E and F grades. The future build alternative (2016) showed an increased LOS by at least one grade at each intersection. Delay times for the existing conditions were too high to be meaningful, however under the alternative, delay times were reduced to 6-7 second delays.
	Model Data		The v/c on Rte. 53 between Mill Street and Pond Street improves from 0.86 to 0.41 from the No-build to the Build cases.
Route 53/228 (Hingham and Norwell)	Model Data	Widen Route 53 in Hingham to a three-lane cross section, to include a center turning lane. Also, widen the approaches at the Route 228 intersection and the High Street/Grove street intersection.	The v/c on Rte. 53/228 near the Norwell town line improves from 0.94 to 0.78 from the No-Build to the Build cases.

TABLE D-1
Project Level Information for Roadway Projects

Project Name	Source	Description of Improvements	Anticipated Benefits
Needham Street/Highland Avenue, Newton and Needham	Newton study in progress; information is from staff involvement in project Model Data	Traffic management improvements, including the redesign and reconstruction of Needham Street as a four-lane road or a three-lane road to accommodate through and turning traffic in/out of commercial and other establishments. Project will reduce congestion and delay and improve safety.	Potential reductions in delay. The v/c on Needham Street south of Centre Street improves from 1.63 to 1.29 from the No-build to the Build cases.
Route 128 Transportation Improvement Project, Randolph to Wellesley	FEIR was completed in 1999; various elements are under design and construction	Design and construct a fourth lane and a shoulder on each barrel of Route 128 between Route 9 and Route 24 (13.7 miles). Design and construct a new interchange at Kendrick Street in Needham, including service roads between Kendrick Street and Highland Avenue. Modify several bridges to accommodate the widening of the main line. Project will improve safety and traffic flow along this section of Route 128.	Significant safety, traffic flow, and access improvements.
Bridge Street By-pass (Salem)	Salem-Beverly transportation project: Salem-Beverly Bridge, Bridge Street by-pass, and Bridge Street Reconstruction, Volume 1: Final Supplemental EIR Massachusetts DPW 1989	Construction of a new road along the North River from Veteran's Memorial Bridge to the vicinity of St. Peter Street and Bridge Street.	This study evaluates the creation of a new road. Existing conditions data looked at surrounding intersections only. The preferred alternative's LOS was found to have a grade of C or higher.
Bridge Street (Salem)	Salem-Beverly transportation project: Salem-Beverly Bridge, Bridge Street by-pass, and Bridge Street Reconstruction, Volume 1: Final Supplemental EIR Massachusetts DPW 1989 Model Data	Widening of Bridge Street from Flint Street to St. Peter Street to two lanes in each direction, including the reconstruction of the Washington Street rotary.	This project considered 5 intersections with Bridge Street. Existing LOS grades for all five intersections was F. Under the new design, all of the five intersections increased their LOS by at least one grade or better (E-B). The v/c on Bridge Street east of Washington Street improves from 1.12 to 0.54 from the No-build to the Build cases.
Route 18 (Weymouth)	Model Data	Widening of Route 18 to two lanes in each direction.	The v/c Rte. 18 south of Rte. 3 improves from 1.45 to 1.21 from the No-build to the Build cases.

Table D-1
Project Level Information for Roadway Projects

Project Name	Source	Description of Improvements	Anticipated Benefits
Route 3 South Additional Lanes (Weymouth to Duxbury)	Model Data	Widen Route 3 from two lanes in each direction to three lanes in each direction from Weymouth to Duxbury. The project also involves design improvements to the interchange ramps at Route 53 in Hanover, Route 139 in Pembroke, and Route 228 in Rockland.	The v/c improves from 1.46 to 1.27 on Rte. 3 at the Hingham line in Weymouth. The v/c improves from 1.14 to 0.88 on Rte. 3 between Exit 11 and 12 in Duxbury.
Route 1A/Boardman Street Grade Separation	Status as of 1999 reporting by MassHighway Planning and Lower North Shore Transportation Improvements Study, CTPS, 2000	Design and construct an interchange to replace the existing traffic signal at Route 1A/Boardman Street. Project includes the relocation of Boardman Street in East Boston approximately 400 feet of the existing location. Additional design features may include Route 1A widening in the vicinity of the interchange. Project will improve traffic safety and traffic flow at this location.	Overpass will reduce congestion, and will provide for safe and efficient traffic flow through this location.
Rutherford Avenue (Boston)	Model Data	From City Square to the Tobin Bridge ramps, Rutherford is reduced from 10 lanes to 5 (3 southbound and 2 northbound). From the Tobin ramps to Bunker Hill Community College, southbound traffic is on the surface with intersection at Gilmore Bridge. Northbound traffic is in a one-way neighborhood street separated from the southbound lanes by a landscape buffer. Route 99 underpass remains. Surface intersections in Sullivan Square replace rotary. One lane of Rutherford is eliminated in each direction at Sullivan.	The v/c on Rutherford Avenue near City Square degrades from 0.82 to 1.41 from the No-build to the Build cases.
Route 1A/Chelsea Street Bridge Connection, Chelsea, Boston	Lower North Shore Transportation Improvements Study, CTPS 2000 Model Data	Design and construct a fly-over connection between Route 1A and the new Chelsea Street Bridge. To improve access, especially for trucks, between Route 1A, and Logan Airport, and the new Chelsea Street Bridge. Project will reduce congestion at Day Square in East Boston, which all Chelsea-bound traffic now uses.	Direct access for trucks and other traffic will eliminate circuitous travel, reduce cut-through traffic in Chelsea and East Boston, and improve congestion and safety. The v/c on Rte. 1A at the Chelsea city line improves from 1.62 to 0.88 from the No-build to the Build cases.

TABLE D-1
Project Level Information for Roadway Projects

Project Name	Source	Description of Improvements	Anticipated Benefits
I-93/I-95 Interchange, Canton	University Avenue/I-95/I-93 Regional Traffic Study, CTPS, 1999; project to enter environmental stage soon	New I-95 northbound fly-over ramp New connection between Blue Hill Drive/University Avenue and I-93 southbound A dedicated traffic lane from Route 128 (I-93 southbound) to I-95 northbound. Closure of present Blue Hill Drive on ramp to I-95 southbound.	Significant improvements in safety, especially truck roll-overs. Improvements in congestion and delay due to direct connections and additional capacity.
	Model Data	Project will improve safety and traffic operations at this Interchange location.	The v/c on I-93 east of I-95 improves from 1.32 to 1.15 from the No-build to the Build cases. The v/c on I-95 south of the I-93 interchange degrades from 1.07 to 1.17 from the No-build to the Build cases.
I-95 (NB) Dedham Street Off-Ramp	University Avenue/I-95/I-93 Regional Traffic Study, CTPS, 1999	Design and construct Dedham Street bridge as four lanes. Design and construct northbound off-ramp.	Eliminates circuitous travel through the town of Canton and Neponset Street interchange just south of Dedham Street by providing direct access from I-95.
	Model Data	Project will provide direct access to Canton and Westwood's University Avenue industrial area from I-95 northbound.	The v/c on I-95 south of the I-93 interchange degrades from 1.07 to 1.17 from the No-build to the Build cases.
Concord Rotary, Concord	CTPS Traffic Feasibility Study in progress	Grade separation of the Route 2, Route 2A, Barrett Mill Road, and Commonwealth Avenue traffic movements. Project will improve safety and reduce delays at this location	Significant improvement of safety and reduction in congestion.
I-495/I-290/Route 85 Interchange (Marlborough)	Model Data	Interchange improvements at the junction of I-495 and I-290 include the construction of a flyover ramp from I-495 northbound to I-290 westbound and a flyover ramp from I-290 eastbound to I-495 northbound.	The v/c on I-495 north of I-290 stays the same from the No-Build to the Build cases.
Route 1 Improvements, Malden and Revere	Lower North Shore Transportation Improvements Study, CTPS, 2000	Reconstruct Route 1 between Route 60 and Route 99 to six lanes per direction; reconstruct the Lynn Street/Salem Street interchange and the Route 1/Route 99 interchange; reconstruct the railroad bridge just south of Lynn/Salem streets.	Improvement in roadway's capacity to handle the additional traffic diverted to it because of better connections between Route 1A and Route 1. Significant safety improvements at Lynn/Salem streets interchange.
	Model Data	Project will improve safety and traffic operations between Route 60 and Route 99.	The v/c on Rte. 1 north of the Rte. 60 interchange improves from 1.47 to 1.14 from the No-build to the Build cases.

Table D-1
Project Level Information for Roadway Projects

Project Name	Source	Description of Improvements	Anticipated Benefits
I-93/I-95 interchange improvements, Woburn, Reading	MassHighway/CTPS Feasibility Study in progress Model Data	Reconstruct the interchanges to replace existing substandard loop ramps; eliminate weaving sections within the I-93/I-95 interchange, and between that and the I-95/Mishawan Street interchange. Project will improve safety and traffic operations at the I-93/I-95 and at the I-95/Mishawam Street interchanges	Improved safety and reduced delays at interchange. The v/c on I-93 north of I-95/128 in Woburn and I-93 south of I-95/128 in Stoneham stays the same from the No-build to the Build cases.
Mahoney Circle, Grade separation, Revere	MassHighway Feasibility Study is complete; DEIR in progress	Grade separation of Route 60 and Route 1A at Mahoney Circle. Project will improve safety and reduce congestion at the intersection of Route 1A with Route 60.	Significant improvement of safety and reduction in congestion
Route 1/Route 16 Interchange, Revere	Lower North Shore Transportation Improvement Study, CTPS, 2000	Construct a large radius on-ramp from Route 16 westbound to Route 1 northbound. Construct an off-ramp, with a traffic signal at its end, for the left turns from Route 1 southbound to Route 16 eastbound. This project will establish a direct connection between Route 16 east and Route 1 north, and a connection between Route 1 and Route 16 east.	Provide for a complete connection between Route 16 and Route 1. Reduce cut-through traffic on local streets.
Route 1A/Route 16 Interchange, Revere	Lower North Shore Transportation Improvement Study, CTPS, 2000 Model Data	Construct a partial cloverleaf interchange serving all movements. One new traffic signal will be installed at Route 16/Revere Beach Parkway providing for left turns between Route 1A southbound and Route 16 eastbound. Project will allow for a seamless, direct connection between Route 1 and Route 1A through Route 16,and improve safety and reduce congestion at Route 1A and Route 16.	Along with the Route 1/Route 16 ramps above, it provides for an improved connection between Route 1 and Route 1A. It reduces congestion in Revere. The v/c on Rte. 16 south of the Rte. 1A interchange stays the same from the No-build to the Build cases.
I-93/Mystic Avenue Interchange, Somerville	Mystic Avenue/Route 28//I-93 Interchange Improvement Study, CTPS, 1994 Model Data	At Route 38, place southbound direction of Route 28 in an underpass thus eliminating the traffic signal at Route 38/Route 28 southbound intersection. Project will improve operations and safety in the area or Route 38/Route 28 and I-93 ramps.	Improvement to traffic operations and delays The v/c on I-93 at the Medford town line stays the same from the No-build to the Build cases.

Table D-1
Project Level Information for Roadway Projects

Project Name	Source	Description of Improvements	Anticipated Benefits
I-93/Ballardvale Street Interchange (Wilmington)	I-93/Route 125/Ballardvale Street Interchange Reconstruction & Intersection Improvements, Wilmington, Mass. – FinalEIR/EA MassHighway Department July 2000 Model Data	Reconstruction of the existing ramps at I-93 and the construction of new ramps to I-93 in the northeast and southeast quadrants. Route 125 will also be reconstructed in the vicinity of the interchange and the intersection between Route 125 and Ballardvale Street will be altered.	This study looked at three intersections at I-93/Route 125 and Ballardvale Road. Existing conditions for LOS overall were high on the I-93 ramps (A & B category), yet low for the Ballardvale intersection (F category). This project's alternative design would focus on realignment of all three intersections for increased safety measures and traffic flow, as well as an increased LOS grade to C for the Ballardvale intersection. The v/c on I-93 south of Ballardvale Street stays the same from the No-build to the Build cases.
East/West Connector Road, Canton	Proposed East/West Connector Road, VHB Traffic Study, February 1997	Construct a connector road between Pleasant Street and Turnpike Street (Route 138). Project will eliminate truck traffic from residential streets and direct it to Route 138.	Reduction in truck traffic on residential streets
I-495/South Street New Interchange (Hopkinton)	Model Data	Reconstruction project aligns the I-495 southbound exit with South Street to eliminate the need for EMC-bound vehicles to make a left to cross eastbound South Street traffic.	The v/c on I-495 north of South Street stays the same from the No-build to the Build cases.
Back Bay Turnpike Exit (Boston)	Model Data	Construction of a new slingshot ramp in the Fenway section of Boston that will allow motorists in the Back Bay area of Boston to access the Massachusetts Turnpike eastbound. Currently, motorists in the Back Bay must take local streets through downtown to access South Boston or the tunnels to the airport. This ramp would be in the westbound direction of the Mass Pike at a point just west of Massachusetts Avenue. Traffic would then change directions in a slingshot ramp built above the highway between Charlesgate and Massachusetts Avenue.	The v/c on I-90 in the Back Bay stays the same from the No-build to the Build cases.
New Boston Street Bridge (Woburn)	Model Data	Construct a bridge on New Boston Street at the northern end of the Woburn Industrial Park where New Boston Street crosses the MBTA Lowell Branch commuter rail line.	Calculated data shows an extreme jump in v/c data. The assumption is that this new bridge connection will be used as a major travel route that is currently not in use.
Burgin Parkway (Quincy)	Model Data	Build a flyover to separate Burgin Parkway from Centre Street and improve access from Interstate 93 to the Crown Colony Area	The v/c on Burgin Parkway north of Center Street improves from 1.47 to 0.93 from the No-build to the Build cases.

Table D-1
Project Level Information for Roadway Projects

Project Name	Source	Description of Improvements	Anticipated Benefits
Route 128 Capacity Improvements (Beverly to Peabody)	Model Data	Add one general purpose lane in each direction from Beverly to Peabody.	The v/c on Rte. 128 in Beverly at the Danvers town line improves from 1.15 to 0.95 from the No-build to the Build cases.
Route 128 Capacity Improvements (Lynnfield to Reading)	Model Data	Add one general purpose lane in each direction from Route 28 in Reading to Route 1 in Lynnfield.	The v/c Rte. 128 in Peabody at the Lynnfield town line improves from 1.42 to 1.27 from the No-build to the Build cases.
Rte. 9/Rte. 126 Interchange (Framingham)	Model Data	Improve the existing interchange at Route 9 (Worcester Road) and Route126 (Concord Street). The Route 126 bridge is listed in the Statewide Road and Bridge list and its reconstruction would be a major element of this project.	The v/c on Rte. 9 west of 126 stays the same from the No-build to the Build cases.

TABLE D-2
Project Level Information for Transit Projects

Project Name	Source	Project Description	Forecast Year	Daily Ridership	Anticipated Benefits New Riders (Auto diversions)	Travel Time Savings (hrs)	VMT reduction (Kg)
Arborway Green Line	Ridership forecasts for the Arborway Extn, CTPS study, May 2001.	Restoration of Green Line E branch service from Heath Street to Arborway along S. Hungtington Ave, Center St and South St.	2000	34,850	0	n/a	0
Russia Wharf Terminal	n/a	Construction of a docking facility and passenger shelter at Russia Wharf near South Station. The facility will provide ferry service between South Station and Charleston Navy Yard.		n/a	n/a	n/a	n/a
Silver Line , Phase B	Regional Transportation Plan modeling results, Sept 2001	Construction of a new tunnel from South Station to Boylston Station thorugh Chinatown and connecting the transitway service with Washington Street service.	2025	92,750	n/a	n/a	n/a
New Bedford/ Fall River Extension	Ridership forecasts update for the New Bedford/Fall River Study, CTPS report, August 2000	Extension of the Stoughton commuter rail line through Easton, Taunton and Berkley, then branching into two lines towards Fall River and New Bedford.	2010	4,300	2,950	n/a	198,200
Greenbush Line	Impact of Greenbush Service- CTPS analysis 1996	Extension of the commuter rail line from Braintree to Greenbush in Scituate via stops in Weymouth Landing, Esat Weymouth, West Hingham, Nastasket Junction and North Scituate.	2010	7,800	4,700	n/a	86,160
Medford Hillside Extension	Program for Mass Transportation (PMT), CTPS Report, December 1993	Extension of Green Line service from a relocated Lechmere station to Medford Hillside via new stations at Washington St, School street, Lowell Street and Ball Square.	2020	11,560	3,660	1,160	38,800
Fairmount Line Upgrade	Regional Transportation Plan modeling results, Sept 2001	Upgrade of service on the Fairmont commuter rail line including 15-min headways, extended hours of service, refurbished existing stations and the construction of 5 additional stations.	2025	17,400	n/a	n/a	n/a
Red-Blue Connector	Program for Mass Transportation (PMT), CTPS Report, December 1993	Extension of the Blue Line from Bowdoin Station to Charles Station of the Red Line, providing a transfer between the Red and Blue lines.	2020	19,200	4,970	2,175	30,765
North - South Rail Link	North-South Rail Link Study, CTPS report, December 1996	Construction of a new tunnel from South Station to North Station under the Central Artery alignment and through-routing north and south side commuter lines. There would be one interim station in the vicinity of Aquarium Station. The Rail Link would allow MBTA commuter trains and Amtrak intercity trains to travel from one side of Boston to the other without the need for through passengers to transfer trains.	2020	58,850	21,350	n/a	382,000
Comm. Rail Extn to Marlborough	Commuter Rail extension to Marlborough, CTPS report November 2001	This project involves a 9.5 miles extension of the Framingham commuter rail line to Route I-495 near the Southborough-Marlborough border using the Conrail Fitchburg Secondary Track.		2,730	1,480	287	n/a

Table D-2
Project Level Information for Transit Projects

Project Name	Source	Project Description	Forecast Year	Daily Ridership	Anticipated Benefits: New Riders (Auto diversions)	Anticipated Benefits: Travel Time Savings (hrs)	Anticipated Benefits: VMT reduction (Kg)
Blue Line Extn to Lynn	Program for Mass Transportation (PMT), CTPS Report, December 1993	This project involves extending the Blue Line four miles from its current terminus at Wonderland to Central Square in Lynn. There will be two intermediate stations one in northern Revere and another at West Lynn.	2020	11,340	4,860	893	49,440
Urban Ring Phase I	Ridership Forecasting Urban Ring MIS, CTPS report, August 2001	Urban Ring Phase I includes modifications to existing bus routes, new express bus routes and addition of new crosstown routes.	2025	42,950	6,600	3,590	14,150
Urban Ring Phase II	Ridership Forecasting Urban Ring MIS, CTPS report, August 2001	Phase II includes seven BRTroutes serving imporant activity centers along the Urban Ring corridor. A number of non-redundant crosstown and express bus routes are also included.	2025	106,000	15,000	17,120	52,500
Urban Ring Phase III	Ridership Forecasting Urban Ring MIS, CTPS report, August 2001	In Phase III, a new Urban Ring rail system between the Orange Line at Assembly Sqr and the former Orange Line terminus at Dudley Sqr is added in addition to the service proposed in Phase II.	2025	282,500	46,500	49,185	355,200
New Comm. Rail Stn at Littleton	Ridership and Parking Demand Forecasts for relocated Littleton Station, CTPS memorandum, Sept 1997	The existing commuter rail station will be relocated to a new site off of Route 2 and access to this station will be provided by means of a new interchange between I-495 and Route 2. The new station will have 500 spaces.	2010	200	n/a	n/a	n/a
Planned T parking	n/a	This project involves adding 14,350 new parking spaces at selected MBTA stations where parking shortfalls are projected.	n/a	n/a	n/a	n/a	n/a
Assembly Sqr Orange Line Station	n/a	New Orange Line station located at the edge of the Assembly Sqr development area.	n/a	n/a	n/a	n/a	n/a
LRT on Washington Street	Supplemental ENF, MBTA report 1990	Convert bus rapid transit Silver Line service to light rail from Dudley Square in Roxbury to downtown Boston. There would be five stations along the alignment. LRT vehilces along Washington Street would merge with Green Line service at Boylston and would turn at Park Street or Government Center.	2010	10,350	n/a	n/a	n/a
Comm. Rail Extn to Millis	Commuter Rail Extension to Millis Feasibility Study, CTPS report, March 1998	This project involves a 6.9 mile extension of the Needham Line from Needham Junction to Medfield Junction via the Dover Secondary Track and a 2.2 mile extension to Millis via the Clicquot Secondary Track.		1,360	1,185	n/a	n/a
Airport/Comm. Rail Connection @ Revere	Ridership Forecasts for the Wonderland Connector Study, CTPS Technical Report, July 1998.	The project involves the relocation of Wonderland station on the Blue Line to the west side of Route 1A. This allows for the construction of a new transfer station for commuter rail service on the Newburyport/Rockport line and the MBTA's Blue Line. Passengers from North Shore would be able to transfer across platform from inbound commuter rail trains to inbound Blue Line service to Logan Airport	2010	3,700	1,500	n/a	n/a
Additional Buses	Regional Model	Addition of 100 buses on existing routes where current capacity shows a possible need for additional service.	2025	331,100	n/a	n/a	n/a

Table D-3
Traffic Volume and Volume/Capacity Ratios Along Major Highways: Basic Forecast Scenario, PM PEAK

Roadway	Location	Town	Future Improvement	1995 PMPK	1995 V/C	2025 NB PMPK	NB V/C	B1 PMPK	B1 V/C	B2 PMPK	B2 V/C	B3 PMPK	B3 V/C	
Rte I-93	**Over the Charles River**	**Boston**	**Widen 3 to 4 lanes - NB**	**43,413**	**1.58**	**46,509**	**1.18**	**46,332**	**1.18**	**46,405**	**1.15**	**47,231**	**1.18**	•
Rte I-93	**At Medford TL**	**Somerville**	**Mystic Ave int imp- Bd 1,2,3**	**40,381**	**1.19**	**51,630**	**1.51**	**50,812**	**1.49**	**50,942**	**1.48**	**51,316**	**1.50**	•
Rte I-93	At Stoneham TL	Medford		38,002	1.07	45,429	1.30	44,921	1.30	45,632	1.30	46,026	1.33	
Rte I-93	**South of I-95/128**	**Stoneham**	**Intchnge Improve - Bd 1&3**	**41,381**	**1.14**	**49,377**	**1.45**	**49,223**	**1.46**	**49,581**	**1.46**	**50,631**	**1.51**	•
Rte I-93	**North of I-95/128**	**Woburn**	**Intchnge Improve - Bd 1&3**	**34,899**	**0.99**	**39,675**	**1.22**	**39,775**	**1.23**	**39,714**	**1.23**	**38,678**	**1.20**	•
Rte I-93	**S. of Ballardvale St.**	**Wilmington**	**Intchnge Improve - Bd 1&3**	**31,044**	**0.94**	**38,016**	**1.26**	**38,157**	**1.27**	**38,230**	**1.27**	**38,016**	**1.27**	•
Rte I-93	South of Dascomb Rd	Andover		28,652	1.15	35,391	1.59	35,375	1.59	35,755	1.61	35,197	1.59	
Rte I-93	North of Quincy CL	Boston		36,047	1.10	42,577	1.29	41,773	1.26	42,503	1.28	41,718	1.27	
Rte I-93	North of I-93/128	Quincy		40,333	1.25	45,911	1.47	45,485	1.45	45,994	1.47	45,136	1.44	
Rte I-93	0.7 Miles North of Rte 28	Quincy		39,965	1.07	44,574	1.27	45,462	1.27	44,931	1.27	45,529	1.28	
Rte I-93	**E. of I-95 interchange**	**Canton**	**Intchnge Improve - Bd 1&3**	**41,878**	**1.12**	**46,315**	**1.32**	**51,779**	**1.14**	**46,351**	**1.31**	**51,965**	**1.15**	•
Mass. Tnpk	**Back Bay area**	**Boston**	**U-Turn ramp - Bd 3**	**19,114**	**0.76**	**27,150**	**1.07**	**26,725**	**1.05**	**26,507**	**1.04**	**29,145**	**1.11**	•
Mass. Tnpk	West of Mass Ave	Boston		23,274	0.73	31,785	0.98	31,403	0.97	31,203	0.96	30,494	0.95	
Mass. Tnpk	Over the Charles River	Newton		19,612	0.87	25,053	1.18	24,994	1.18	24,797	1.17	25,032	1.19	
Mass. Tnpk	Btw Interchange 13 & 14	Natick		23,091	0.93	29,098	1.30	29,026	1.29	29,274	1.30	29,140	1.30	
Rte I-95	North of Topsfield TL	Boxford		19,336	0.59	30,809	1.10	30,888	1.10	30,910	1.10	31,280	1.11	
Rte I-95/128	0.5 Miles South of Rte 38	Woburn		40,971	1.06	45,781	1.14	46,139	1.13	45,698	1.13	47,475	1.15	
Rte I-95/128	**North of Rte 129 (Main St)**	**Wakefield**	**Widen 3 to 4 lanes - Bd 3**	**33,424**	**1.26**	**37,970**	**1.46**	**37,712**	**1.44**	**37,305**	**1.41**	**46,068**	**1.30**	•
Rte I-95/128	Btw Interchanges 31 & 30	Lexington		40,568	1.02	47,269	1.23	47,392	1.22	47,118	1.22	47,936	1.24	
Rte I-95/128	**North of Rte 109**	**Dedham**	**Widen 3 to 4 lanes - Bd 1&3**	**33,437**	**1.01**	**39,414**	**1.18**	**45,033**	**1.10**	**39,347**	**1.19**	**45,263**	**1.11**	•
Rte I-95	**S. of I-93 interchange**	**Canton**	**Intchnge Improve - Bd 1&3**	**20,830**	**0.85**	**24,088**	**1.06**	**26,458**	**1.16**	**25,691**	**1.13**	**26,889**	**1.18**	•
Rte I-95	South of Interchange 9 (Rte 1)	Sharon		19,485	0.83	26,119	1.22	26,415	1.23	26,362	1.23	26,527	1.24	
Rte I-495	Btw Interchange 51 & 52	Haverhill		13,464	0.43	18,284	0.59	18,251	0.59	18,233	0.59	18,000	0.58	
Rte I-495	Btw Interchanges 32 & 33	Westford		19,180	0.63	26,201	0.87	26,110	0.87	26,298	0.88	26,229	0.87	
Rte I-495	**N. of I-290**	**Marlborough**	**Intchnge Improve - Bd 1&3**	**21,235**	**0.68**	**29,625**	**0.98**	**29,311**	**0.97**	**29,593**	**0.98**	**29,274**	**0.97**	•
Rte I-495	**N. of South St.**	**Hopkinton**	**Realign SB Exit - Bd 1**	**21,242**	**0.81**	**30,794**	**1.11**	**30,455**	**1.11**	**30,884**	**1.12**	**30,019**	**1.08**	•
Rte I-495	South of Rte 109 (Medway St)	Milford		17,366	0.64	25,298	0.87	24,708	0.86	25,232	0.87	24,724	0.86	

Note: Bullet (•) and shading indicate future year highway improvement along the segment

Table D-3
Traffic Volume and Volume/Capacity Ratios Along Major Highways: Basic Forecast Scenario, PM PEAK

Roadway	Location	Town	Future Improvement	1995 PMPK	1995 V/C	2025 NB PMPK	2025 NB V/C	2025 B1 PMPK	2025 B1 V/C	2025 B2 PMPK	2025 B2 V/C	2025 B3 PMPK	2025 B3 V/C	
Rte 1	**North of Rte 60 Interchange**	**Revere**	**Widen 2 to 3 lanes - Bd 1&3**	**21,024**	**1.15**	**24,221**	**1.46**	**27,280**	**1.14**	**24,504**	**1.51**	**26,623**	**1.13**	•
Rte 1	Btw Salem St & Maple St	Lynnfield		28,629	0.98	33,893	1.30	34,239	1.33	34,447	1.34	34,049	1.34	
Rte 1	North of Elm St	Dedham		14,065	0.99	15,974	1.22	16,060	1.20	15,692	1.16	15,605	1.16	
Rte 1A	**Chelsea CL**	**Boston**	**Bridge/1A connect.-Bd 1,2,3**	**4,552**	**1.07**	**5,348**	**1.62**	**10,181**	**0.88**	**10,786**	**0.85**	**10,136**	**0.89**	•
Rte 1A	At Revere CL	Lynn		11,643	1.47	14,801	1.87	14,523	1.82	14,740	1.86	14,050	1.76	
Rte 1A	**At Beverly Salem Bridge**	**Beverly**	**Widen 1 to 2 lanes - NB**	**6,147**	**1.49**	**7,819**	**1.01**	**8,770**	**1.11**	**8,740**	**1.10**	**8,654**	**1.08**	•
Rte 1A	At Norfolk TL	Walpole		1,871	0.49	3,005	0.85	2,972	0.84	3,030	0.86	2,987	0.84	
Rte 2	At Belmont TL	Cambridge		16,534	0.97	18,566	1.19	18,893	1.21	19,053	1.22	18,557	1.18	
Rte 2	East of Rte I-95/128	Lexington		23,005	0.79	26,855	1.08	26,829	1.08	27,110	1.09	26,968	1.08	
Rte 2	Over Sudbury River	Concord		11,254	1.08	12,563	1.32	12,699	1.35	13,192	1.45	13,053	1.42	
Rte 2	**Acton TL**	**Concord**	**Rte 2/2A int - Bd 1&3**	**10,188**	**1.06**	**12,595**	**1.43**	**12,306**	**1.51**	**12,759**	**1.60**	**12,218**	**1.48**	•
Rte 2A	E. of I-95/Rte 128	Lexington		2,287	0.22	3,907	0.49	3,861	0.47	3,979	0.48	4,064	0.50	
Rte 3	**South of Concord Rd**	**Billerica**	**Widen 2 to 3 lanes - NB**	**19,380**	**1.10**	**30,147**	**1.36**	**29,218**	**1.31**	**30,447**	**1.38**	**29,825**	**1.35**	•
Rte 3	**Hingham Line**	**Weymouth**	**Widen 2 to 3 lanes - Bd 1&3**	**26,599**	**1.23**	**30,706**	**1.46**	**32,540**	**1.26**	**29,465**	**1.38**	**32,540**	**1.27**	•
Rte 3	**Exit 11 to 12**	**Duxbury**	**Widen 2 to 3 lanes - Bd 1&3**	**14,071**	**0.88**	**18,199**	**1.14**	**20,552**	**0.88**	**18,087**	**1.13**	**20,619**	**0.89**	•
Rte 3A	S. of Boston City Line	Quincy		16,754	1.20	18,386	1.37	18,173	1.36	18,135	1.34	18,288	1.37	
Rte 3A	S. of Cornet Stetson Rd	Scituate		4,042	0.81	4,598	0.99	4,660	1.02	4,774	1.06	4,580	0.99	
Rte 9	East of Hammond St	Brookline		8,435	0.96	9,812	1.16	9,547	1.14	9,693	1.14	9,767	1.18	
Rte 9	Btw Rte I-95/128 & Williams St	Wellesley		12,831	1.22	13,659	1.34	13,085	1.30	13,691	1.34	13,190	1.33	
Rte 9	Over Lake Cochituate	Natick		13,373	1.24	15,202	1.49	15,210	1.50	15,218	1.50	15,220	1.49	
Rte 9	**West of Rte 126**	**Framingham**	**New Ramp - Bd 3**	**10,069**	**0.96**	**11,105**	**1.14**	**11,177**	**1.14**	**11,182**	**1.15**	**11,208**	**1.14**	•
Rte 14	At Hanson TL	Pembroke		2,282	0.50	3,134	0.70	3,029	0.68	3,108	0.70	3,040	0.67	
Rte 16	**S. of Rte 1A interchange**	**Revere**	**New ramp - Bd 1,2,3**	**26,813**	**1.07**	**29,783**	**1.16**	**29,716**	**1.16**	**29,879**	**1.19**	**29,702**	**1.17**	•
Rte 16	W. of Malden St & Everett St	Everett		11,591	0.84	13,034	0.94	13,085	0.97	13,352	1.01	13,300	1.01	
Rte 16	Btw Rte I-95/128 & Beacon St	Newton		5,593	1.53	6,542	1.93	6,459	1.88	6,267	1.85	6,369	1.83	
Rte 16	Btw Ale Brk Pkwy & Bos Ave	Somerville		7,028	0.87	8,032	0.95	8,691	1.05	8,429	1.02	8,690	1.07	
Rte 16	W. of Sawin St.	Sherborn		7,193	0.71	9,420	0.99	9,420	0.99	9,420	0.99	9,420	0.99	
Rte 18	**South of Rte 3**	**Weymouth**	**Widen 1 to 2 lanes - Bd 1&3**	**6,008**	**1.48**	**5,956**	**1.45**	**8,924**	**1.19**	**6,169**	**1.55**	**8,973**	**1.21**	•

Note: Bullet (•) and shading indicate future year highway improvement along the segment

Table D-3
Traffic Volume and Volume/Capacity Ratios Along Major Highways: Basic Forecast Scenario, PM PEAK

Roadway	Location	Town	Future Improvement	1995		2025								
						NB		B1		B2		B3		
				PMPK	V/C	PMPK	V/C	PMPK	V/C	PMPK	V/C	PMPK	V/C	
Rte 20	W. of I-95	Marlborough		3,990	0.97	4,751	1.25	4,787	1.28	4,755	1.29	4,656	1.26	
Rte 24	North of Intchange 18 (Rte 27)	Brockton		27,110	1.05	31,593	1.32	31,507	1.31	31,295	1.31	31,539	1.31	
Rte 27	N. of Zions Ln	Sherborn		5,112	1.14	6,570	1.66	6,530	1.66	6,665	1.71	6,614	1.69	
Rte 27	N. of Rte 2A	Acton		2,157	0.44	2,905	0.57	2,943	0.58	2,884	0.56	2,946	0.58	
Rte 28	Avon TL	Randolph		4,898	1.02	5,661	1.24	5,664	1.25	5,640	1.25	5,631	1.23	
Rte 28	Reading TL	Stoneham		8,255	0.99	9,793	1.27	9,996	1.30	9,812	1.24	9,857	1.29	
Rte 30	W. of Valley Rd.	Southborough		2,948	0.79	4,448	1.23	4,365	1.22	4,354	1.21	4,390	1.23	
Rte 37	S. of Partridge Hill Rd.	Braintree		3,560	0.80	3,938	0.93	3,818	0.92	3,752	0.88	3,709	0.89	
Rte 38	Tewksbury TL	Wilmington		2,810	0.80	4,183	1.24	3,992	1.16	4,040	1.17	4,005	1.18	
Rte 38	Medford CL	Somerville		8,383	1.04	9,702	1.25	9,614	1.23	9,588	1.23	9,708	1.24	
Rte 53	**Mill St. to Pond St.**	**Hanover**	**Widen to 5-lanes - Bd 1&3**	**2,411**	**0.59**	**3,012**	**0.86**	**3,118**	**0.41**	**2,805**	**0.79**	**3,102**	**0.41**	•
Rte 53/228	**Near Norwell TL**	**Hingham**	**Add ctr turn lane - Bd 1&3**	**3,228**	**0.69**	**4,068**	**0.94**	**4,044**	**0.78**	**3,756**	**0.86**	**4,027**	**0.77**	•
Rte 85	Hopkinton TL	Milford		1,591	0.40	2,671	0.70	2,602	0.73	2,630	0.68	2,646	0.68	
Rte 99	Btw Central St & Summit St	Malden		3,496	0.48	4,631	0.68	4,147	0.56	4,678	0.65	3,977	0.53	
Rte 109	Millis TL	Medway		3,804	0.79	4,718	1.09	4,619	1.05	4,598	1.04	4,549	1.03	
Rte 114	**Watson Pkwy to RR Bridge**	**Danvers**	**Widen 1 to 2 lanes - Bd 1 &3**	**6,063**	**0.59**	**6,953**	**0.70**	**7,268**	**0.52**	**7,064**	**0.72**	**7,220**	**0.52**	•
Rte 117	S. of East End Rd.	Bolton		2,082	0.50	3,944	0.91	4,081	0.92	4,041	0.90	3,950	0.89	
Rte 123	Hanover TL	Rockland		4,012	0.80	4,538	0.98	4,280	0.96	4,430	0.94	4,332	0.96	
Rte 126	**North of Rte 135**	**Framingham**	**Grade separation - Bd 1&2**	**5,572**	**1.79**	**6,237**	**2.07**	**6,798**	**1.35**	**6,864**	**1.37**	**6,151**	**1.85**	•
Rte 126	S. of South Main St.	Bellingham		3,178	0.86	4,452	1.20	4,459	1.20	4,481	1.21	4,492	1.21	
Rte 128	**Lynnfield TL**	**Peabody**	**Add 1 lane each dir - Bd 3**	**32,632**	**1.15**	**38,383**	**1.42**	**38,147**	**1.40**	**37,626**	**1.36**	**46,380**	**1.27**	•
Rte 128	**Danvers TL**	**Beverly**	**Add 1 lane each dir - Bd 3**	**19,540**	**1.03**	**21,496**	**1.15**	**21,264**	**1.15**	**21,254**	**1.13**	**25,753**	**0.95**	•
Rte 129	N. of Water St.	Wakefield		2,741	0.93	3,327	1.06	3,058	1.01	3,222	1.02	2,963	0.99	

Note: Bullet (•) and shading indicate future year highway improvement along the segment

TABLE D-3
Traffic Volume and Volume/Capacity Ratios Along Major Highways: Basic Forecast Scenario, PM PEAK

Roadway	Location	Town	Future Improvement	1995 PMPK	1995 V/C	2025 NB PMPK	NB V/C	B1 PMPK	B1 V/C	B2 PMPK	B2 V/C	B3 PMPK	B3 V/C	
Rte 135	**West of Rte 126**	**Framingham**	**Grade separation - Bd 1&2**	**5,245**	**1.37**	**6,016**	**1.62**	**6,112**	**1.68**	**6,061**	**1.67**	**6,001**	**1.65**	•
Rte 138	N. of Atherton St.	Milton		2,551	0.26	3,244	0.37	3,200	0.37	3,320	0.38	3,223	0.37	
Rte 139	Abington TL	Rockland		5,302	1.31	6,149	1.49	5,530	1.34	6,084	1.45	5,512	1.33	
Rte 140	**North of I-495**	**Franklin**	**Widen 1 to 2 lanes - Bd 1,2,3**	**3,979**	**0.91**	**5,535**	**1.26**	**7,268**	**0.88**	**6,975**	**0.83**	**7,201**	**0.86**	•
Rte 140	Mansfield TL	Foxborough		7,356	0.77	9,183	0.97	9,183	0.97	9,090	0.98	9,019	0.98	
Bridge St	**E. of Washington St.**	**Salem**	**Build Bypass - Bd 1,2,3**	**4,056**	**1.03**	**4,547**	**1.12**	**4,317**	**0.53**	**4,321**	**0.56**	**4,212**	**0.54**	•
Burgin Pkwy	**N. of Centre St.**	**Quincy**	**Flyover @ Centre St - Bd 3**	**10,677**	**1.13**	**12,612**	**1.47**	**12,595**	**1.42**	**12,546**	**1.46**	**9,000**	**0.93**	•
Crosby Dr	**Rte 3 to Middlesex Tpk**	**Bedford**	**Widen 1 to 2 lanes - Bd 1&3**	**801**	**0.31**	**1,204**	**0.29**	**1,752**	**0.25**	**1,830**	**0.35**	**1,560**	**0.22**	•
Middlesex Tpk	**South of Concord Rd.**	**Billerica**	**Widen 1 to 2 lanes - Bd 1&3**	**3,800**	**0.99**	**5,706**	**1.47**	**8,893**	**1.22**	**5,953**	**1.52**	**8,939**	**1.24**	•
Middlesex Tpk	**North of Lexington St.**	**Burlington**	**Widen 1 to 2 lanes - Bd 1&3**	**3,727**	**0.97**	**4,939**	**1.19**	**7,703**	**0.97**	**5,063**	**1.22**	**7,649**	**0.96**	•
Mystic Ave	**South of I-93 Exit 28**	**Somerville**	**Intchnge Improve - Bd 1,2,3**	**4,626**	**0.47**	**6,758**	**0.68**	**5,985**	**0.61**	**5,799**	**0.59**	**5,898**	**0.60**	•
Needham St.	**South of Centre St.**	**Newton**	**Widen 1 to 2 lanes - Bd 1,2,3**	**5,228**	**1.46**	**5,660**	**1.63**	**8,655**	**1.29**	**8,538**	**1.28**	**8,750**	**1.32**	•
New Boston St.	**North of Merrimack St.**	**Woburn**	**Construct bridge - Bd 3**	**99**	**0.02**	**165**	**0.03**	**169**	**0.04**	**167**	**0.04**	**3,488**	**0.90**	•
Rutherford Ave	**Near City Square**	**Boston**	**Reduce lanes - Bd 1&2**	**11,952**	**0.72**	**11,831**	**0.82**	**10,409**	**1.41**	**10,873**	**1.42**	**11,089**	**0.79**	•
Storrow Dr	W. of On-ramp from Mass Ave	Boston		19,935	1.14	21,818	1.25	21,691	1.25	21,707	1.26	21,747	1.24	

Note: Bullet (•) and shading indicate future year highway improvement along the segment

Table D-3
Traffic Volume and Volume/Capacity Ratios Along Major Highways: Targeted Growth Scenario, PM PEAK

Roadway	Location	Town	Future Improvement	1995 PMPK	1995 V/C	2025 NB PMPK	NB V/C	B1 PMPK	B1 V/C	B2 PMPK	B2 V/C	Final Build AMPK	Final Build V/C	
Rte I-93	**Over the Charles River**	**Boston**	**Widen 3 to 4 lanes - NB**	**43,413**	**1.58**	**47,398**	**1.20**	**47,404**	**1.19**	**47,110**	**1.19**	**47,634**	**1.19**	•
Rte I-93	**At Medford TL**	**Somerville**	**Mystic Ave int imp- Bd 1,2,3**	**40,381**	**1.19**	**52,122**	**1.52**	**51,083**	**1.48**	**51,335**	**1.48**	**51,733**	**1.50**	•
Rte I-93	At Stoneham TL	Medford		38,002	1.07	45,385	1.28	46,078	1.34	46,065	1.31	46,144	1.31	
Rte I-93	**South of I-95/128**	**Stoneham**	**Intchnge Improve - Bd 1,3,SA**	**41,381**	**1.14**	**49,401**	**1.44**	**50,053**	**1.47**	**49,982**	**1.46**	**50,680**	**1.48**	•
Rte I-93	**North of I-95/128**	**Woburn**	**Intchnge Improve - Bd 1,3,SA**	**34,899**	**0.99**	**39,214**	**1.19**	**39,373**	**1.20**	**39,537**	**1.21**	**38,586**	**1.18**	•
Rte I-93	**S. of Ballardvale St.**	**Wilmington**	**Intchnge Improve - Bd 1,3,SA**	**31,044**	**0.94**	**37,485**	**1.23**	**37,487**	**1.22**	**37,706**	**1.23**	**37,148**	**1.21**	•
Rte I-93	South of Dascomb Rd	Andover		28,652	1.15	34,735	1.53	34,982	1.55	34,908	1.54	34,597	1.53	
Rte I-93	North of Quincy CL	Boston		36,047	1.10	43,473	1.33	42,623	1.30	42,776	1.29	42,433	1.29	
Rte I-93	North of I-93/128	Quincy		40,333	1.25	46,471	1.49	46,105	1.48	45,944	1.47	45,872	1.47	
Rte I-93	0.7 Miles North of Rte 28	Quincy		39,965	1.07	44,900	1.26	45,983	1.27	44,987	1.26	45,784	1.27	
Rte I-93	**E. of I-95 interchange**	**Canton**	**Intchnge Improve - Bd 1,3,SA**	**41,878**	**1.12**	**46,784**	**1.31**	**52,469**	**1.14**	**46,883**	**1.30**	**52,540**	**1.14**	•
Mass. Tnpk	**Back Bay area**	**Boston**	**U-Turn ramp - Bd 3**	**19,114**	**0.76**	**27,586**	**1.08**	**27,177**	**1.05**	**27,165**	**1.05**	**27,370**	**1.06**	•
Mass. Tnpk	West of Mass Ave	Boston		23,274	0.73	32,338	0.99	31,939	0.97	31,875	0.97	32,167	0.98	
Mass. Tnpk	Over the Charles River	Newton		19,612	0.87	25,544	1.18	25,485	1.18	25,132	1.16	25,687	1.19	
Mass. Tnpk	Btw Interchange 13 & 14	Natick		23,091	0.93	29,090	1.27	29,094	1.26	29,127	1.27	29,102	1.27	
Rte I-95	North of Topsfield TL	Boxford		19,336	0.59	28,990	1.02	28,907	1.01	28,969	1.01	29,376	1.02	
Rte I-95/128	0.5 Miles South of Rte 38	Woburn		40,971	1.06	45,743	1.14	46,723	1.14	46,037	1.14	47,272	1.16	
Rte I-95/128	**North of Rte 129 (Main St)**	**Wakefield**	**Widen 3 to 4 lanes - Bd 3,SA**	**33,424**	**1.26**	**37,793**	**1.45**	**37,719**	**1.43**	**37,743**	**1.44**	**46,349**	**1.31**	•
Rte I-95/128	Btw Interchanges 31 & 30	Lexington		40,568	1.02	47,158	1.21	47,546	1.22	47,074	1.22	47,598	1.22	
Rte I-95/128	**North of Rte 109**	**Dedham**	**Widen 3 to 4 lanes - Bd 1,3,SA**	**33,437**	**1.01**	**39,502**	**1.20**	**45,357**	**1.11**	**39,672**	**1.20**	**45,475**	**1.12**	•
Rte I-95	**S. of I-93 interchange**	**Canton**	**Intchnge Improve - Bd 1,3,SA**	**20,830**	**0.85**	**24,689**	**1.08**	**26,812**	**1.16**	**25,473**	**1.10**	**26,728**	**1.15**	•
Rte I-95	South of Interchange 9 (Rte 1)	Sharon		19,485	0.83	25,500	1.17	25,675	1.18	25,689	1.18	25,920	1.19	
Rte I-495	Btw Interchange 51 & 52	Haverhill		13,464	0.43	17,555	0.56	17,089	0.56	17,536	0.56	17,195	0.55	
Rte I-495	Btw Interchanges 32 & 33	Westford		19,180	0.63	25,685	0.86	25,571	0.86	25,644	0.86	25,488	0.86	
Rte I-495	**N. of I-290**	**Marlborough**	**Intchnge Improve - Bd 1,3,SA**	**21,235**	**0.68**	**28,977**	**0.96**	**28,608**	**0.95**	**28,847**	**0.96**	**28,627**	**0.95**	•
Rte I-495	**N. of South St.**	**Hopkinton**	**Realign SB Exit - Bd 1**	**21,242**	**0.81**	**30,152**	**1.10**	**29,795**	**1.09**	**30,199**	**1.11**	**29,466**	**1.07**	•
Rte I-495	South of Rte 109 (Medway St)	Milford		17,366	0.64	25,116	0.88	24,524	0.86	24,970	0.87	24,519	0.86	

Note: Bullet (•) and shading indicate future year highway improvement along the segment

TABLE D-3
Traffic Volume and Volume/Capacity Ratios Along Major Highways: Targeted Growth Scenario, PM PEAK

Roadway	Location	Town	Future Improvement	1995		2025								
						NB		B1		B2		Final Build		
				PMPK	V/C	PMPK	V/C	PMPK	V/C	PMPK	V/C	AMPK	V/C	
Rte 1	**North of Rte 60 Interchange**	**Revere**	**Widen 2 to 3 lanes - Bd 1,3,SA**	**21,024**	**1.15**	**24,748**	**1.48**	**27,621**	**1.14**	**24,418**	**1.48**	**26,830**	**1.12**	•
Rte 1	Btw Salem St & Maple St	Lynnfield		28,629	0.98	34,539	1.31	34,718	1.34	34,205	1.30	34,294	1.33	
Rte 1	North of Elm St	Dedham		14,065	0.99	15,775	1.17	15,730	1.15	15,738	1.16	16,029	1.19	
Rte 1A	**Chelsea CL**	**Boston**	**Bridge/1A connect.-Bd 1,2,3**	**4,552**	**1.07**	**5,701**	**1.79**	**9,958**	**0.86**	**10,073**	**0.86**	**5,000**	**1.70**	•
Rte 1A	At Revere CL	Lynn		11,643	1.47	15,230	1.89	15,021	1.88	15,246	1.89	14,954	1.85	
Rte 1A	**At Beverly Salem Bridge**	**Beverly**	**Widen 1 to 2 lanes - NB**	**6,147**	**1.49**	**7,979**	**1.00**	**8,960**	**1.11**	**8,945**	**1.11**	**8,761**	**1.06**	•
Rte 1A	At Norfolk TL	Walpole		1,871	0.49	3,000	0.85	2,869	0.80	2,934	0.83	2,937	0.83	
Rte 2	At Belmont TL	Cambridge		16,534	0.97	18,768	1.18	19,373	1.23	19,083	1.19	18,825	1.17	
Rte 2	East of Rte I-95/128	Lexington		23,005	0.79	27,108	1.06	27,131	1.07	27,136	1.07	26,946	1.05	
Rte 2	Over Sudbury River	Concord		11,254	1.08	13,029	1.39	12,851	1.39	11,916	1.23	12,990	1.42	
Rte 2	**Acton TL**	**Concord**	**Rte 2/2A int - Bd 1,3,SA**	**10,188**	**1.06**	**12,619**	**1.48**	**11,920**	**1.42**	**12,024**	**1.48**	**11,361**	**1.39**	•
Rte 2A	E. of I-95/Rte 128	Lexington		2,287	0.22	3,924	0.46	3,880	0.47	4,208	0.51	3,916	0.47	
Rte 3	**South of Concord Rd**	**Billerica**	**Widen 2 to 3 lanes - NB**	**19,380**	**1.10**	**29,617**	**1.33**	**28,770**	**1.28**	**29,677**	**1.32**	**28,882**	**1.28**	•
Rte 3	**Hingham Line**	**Weymouth**	**Widen 2 to 3 lanes - Bd 1,3,SA**	**26,599**	**1.23**	**30,854**	**1.47**	**32,704**	**1.27**	**29,745**	**1.40**	**32,518**	**1.26**	•
Rte 3	**Exit 11 to 12**	**Duxbury**	**Widen 2 to 3 lanes - Bd 1,3,SA**	**14,071**	**0.88**	**18,067**	**1.13**	**20,381**	**0.87**	**17,912**	**1.12**	**20,294**	**0.87**	•
Rte 3A	S. of Boston City Line	Quincy		16,754	1.20	18,970	1.42	18,747	1.42	18,728	1.40	18,878	1.43	
Rte 3A	S. of Cornet Stetson Rd	Scituate		4,042	0.81	4,523	0.97	4,576	1.01	4,643	1.03	4,553	1.00	
Rte 9	East of Hammond St	Brookline		8,435	0.96	9,977	1.17	10,215	1.22	9,895	1.16	10,106	1.19	
Rte 9	Btw Rte I-95/128 & Williams St	Wellesley		12,831	1.22	13,807	1.36	13,280	1.32	13,589	1.31	13,004	1.28	
Rte 9	Over Lake Cochituate	Natick		13,373	1.24	15,021	1.45	15,154	1.46	15,080	1.46	15,076	1.45	
Rte 9	**West of Rte 126**	**Framingham**	**New Ramp - Bd 3,SA**	**10,069**	**0.96**	**11,016**	**1.10**	**11,053**	**1.11**	**11,026**	**1.10**	**11,035**	**1.10**	•
Rte 14	At Hanson TL	Pembroke		2,282	0.50	2,898	0.65	2,870	0.64	2,905	0.61	2,871	0.63	
Rte 16	**S. of Rte 1A interchange**	**Revere**	**New ramp - Bd 1,2,3,SA**	**26,813**	**1.07**	**30,916**	**1.21**	**30,448**	**1.20**	**29,813**	**1.15**	**30,116**	**1.17**	•
Rte 16	W. of Malden St & Everett St	Everett		11,591	0.84	13,136	0.93	13,231	0.97	13,586	1.02	13,145	0.93	
Rte 16	Btw Rte I-95/128 & Beacon St	Newton		5,593	1.53	6,545	1.86	6,393	1.78	6,611	1.88	7,068	2.08	
Rte 16	Btw Ale Brk Pkwy & Bos Ave	Somerville		7,028	0.87	8,506	1.00	8,347	1.03	8,517	1.01	8,856	1.07	
Rte 16	W. of Sawin St.	Sherborn		7,193	0.71	9,266	0.97	9,266	0.97	9,267	0.97	9,266	0.97	
Rte 18	**South of Rte 3**	**Weymouth**	**Widen 1 to 2 lanes - Bd 1,3,SA**	**6,008**	**1.48**	**5,685**	**1.41**	**8,862**	**1.22**	**5,880**	**1.48**	**9,243**	**1.29**	•

Note: Bullet (•) and shading indicate future year highway improvement along the segment

TABLE D-3
Traffic Volume and Volume/Capacity Ratios Along Major Highways: Targeted Growth Scenario, PM PEAK

Roadway	Location	Town	Future Improvement	1995		2025								
						NB		B1		B2		Final Build		
				PMPK	V/C	PMPK	V/C	PMPK	V/C	PMPK	V/C	AMPK	V/C	
Rte 135	**West of Rte 126**	**Framingham**	**Grade separation - Bd 1,2,SA**	**5,245**	**1.37**	**5,978**	**1.59**	**5,949**	**1.59**	**5,973**	**1.60**	**6,003**	**1.61**	•
Rte 138	N. of Atherton St.	Milton		2,551	0.26	3,393	0.39	3,343	0.39	3,479	0.40	3,364	0.39	
Rte 139	Abington TL	Rockland		5,302	1.31	5,864	1.41	5,400	1.31	5,870	1.40	5,253	1.26	
Rte 140	**North of I-495**	**Franklin**	**Widen 1 to 2 lanes - Bd 1,2,3,SA**	**3,979**	**0.91**	**5,300**	**1.16**	**7,060**	**0.84**	**6,851**	**0.79**	**7,060**	**0.83**	•
Rte 140	Mansfield TL	Foxborough		7,356	0.77	9,107	0.99	8,976	0.98	8,726	0.93	9,025	0.97	
Bridge St	**E. of Washington St.**	**Salem**	**Build Bypass - Bd 1,2,3,SA**	**4,056**	**1.03**	**4,605**	**1.18**	**4,308**	**0.56**	**4,287**	**0.55**	**4,340**	**0.55**	•
Burgin Pkwy	**N. of Centre St.**	**Quincy**	**Flyover @ Centre St - Bd 3,SA**	**10,677**	**1.13**	**12,615**	**1.45**	**13,539**	**1.55**	**12,880**	**1.48**	**9,259**	**0.94**	•
Crosby Dr	**Rte 3 to Middlesex Tpk**	**Bedford**	**Widen 1 to 2 lanes - Bd 1,3,SA**	**801**	**0.31**	**1,371**	**0.39**	**1,596**	**0.22**	**945**	**0.31**	**1,928**	**0.28**	•
Middlesex Tpk	**South of Concord Rd.**	**Billerica**	**Widen 1 to 2 lanes - Bd 1,3,SA**	**3,800**	**0.99**	**5,577**	**1.42**	**8,857**	**1.20**	**5,619**	**1.41**	**8,640**	**1.16**	•
Middlesex Tpk	**North of Lexington St.**	**Burlington**	**Widen 1 to 2 lanes - Bd 1,3,SA**	**3,727**	**0.97**	**4,986**	**1.22**	**7,592**	**0.93**	**5,073**	**1.22**	**7,574**	**0.92**	•
Mystic Ave	**South of I-93 Exit 28**	**Somerville**	**Intchnge Improve - Bd 1,2,3**	**4,626**	**0.47**	**6,806**	**0.69**	**5,613**	**0.57**	**5,538**	**0.56**	**5,909**	**0.60**	•
Needham St.	**South of Centre St.**	**Newton**	**Widen 1 to 2 lanes - Bd 1,2,3,SA**	**5,228**	**1.46**	**5,899**	**1.69**	**9,043**	**1.35**	**8,603**	**1.26**	**8,670**	**1.26**	•
New Boston St.	**North of Merrimack St.**	**Woburn**	**Construct bridge - Bd 3,SA**	**99**	**0.02**	**174**	**0.03**	**175**	**0.03**	**161**	**0.03**	**3,706**	**0.99**	•
Rutherford Ave	**Near City Square**	**Boston**	**Reduce lanes - Bd 1&2,SA**	**11,952**	**0.72**	**11,916**	**0.82**	**10,322**	**1.42**	**10,092**	**1.40**	**10,590**	**1.46**	•
Storrow Dr	W. of On-ramp from Mass Ave	Boston		19,935	1.14	21,937	1.25	21,697	1.27	21,809	1.27	21,649	1.26	

Note: Bullet (•) and shading indicate future year highway improvement along the segment

Table D-4
Transit Capacity Analysis: Basic Forecast

	1995 Capacity	2025 Capacity	1995 Demand		2025 Demand Basic Forecast No-Build		2025 Demand Basic Forecast Build-1		2025 Demand Basic Forecast Build-2		2025 Demand Basic Forecast Build-3	
	AM	AM	AM	*AM V/C*	AM	*AM V/C*	AM	*AM V/C*	AM	*AM V/C*	AM	*AM V/C*
Rapid Transit												
Blue Line ***into Aquarium***	20520	25650	14900	0.73	19790	0.96	20344	0.99	20479	1.00	20702	1.01
Orange Line-North ***into North Station***	23580	35370	18150	0.77	23250	0.99	22494	0.95	23217	0.98	24198	1.03
Orange Line-South ***into Mass Ave***	23580	35370	16900	0.72	31180	1.32	26825	1.14	29564	1.25	30752	1.30
Red Line-North ***into Charles/MGH***	29160	43740	18800	0.64	25554	0.88	24030	0.82	26292	0.90	23216	0.80
Red Line-South ***into Broadway***	29160	43740	24500	0.84	42092	1.44	29180	1.00	28735	0.99	29097	1.00
Green Line-West ***into Arlington***	19800	29700	26800	1.35	32952	1.11	36067	1.21	34161	1.15	35364	1.19
Green Line-East ***into Govt Center***	19800	29700	21900	1.11	24263	0.82	25862	0.87	25345	0.85	25313	0.85
Commuter Rail	**1995 Peak Direction Capacity**	**2025 Peak Direction Capacity**										
Rockport/Ipswich/Newburyport	5593.5	5593.5	4545	0.81	8298	1.48	8505	1.52	10746	1.92	7767	1.39
Haverhill/Reading	3729	3729	2700	0.72	8451	2.27	8145	2.18	8919	2.39	7767	2.08
Lowell	3108	3108	2727	0.88	8010	2.58	7335	2.36	8028	2.58	7875	2.53
Fitchburg	3108	3108	2457	0.79	7974	2.57	7839	2.52	7506	2.42	7695	2.48
Framingham	6760	6760	3915	0.58	8343	1.23	8055	1.19	8334	1.23	7974	1.18
Needham	4225	4225	2745	0.65	3078	0.73	2835	0.67	2871	0.68	2898	0.69
Franklin	5070	5070	5067	1.00	10431	2.06	10071	1.99	10296	2.03	10323	2.04
Attleboro/Stoughton	8450	8450	9027	1.07	13500	1.60	13257	1.57	13482	1.60	12915	1.53
Fairmount	5915	5915	1035	0.17	1224	0.21	3222	0.54	3159	0.53	2961	0.50
Middleboro (2025 only)	3380	3380	-	-	4581	1.36	4356	1.29	4770	1.41	4338	1.28
Plymouth (2025 only)	3380	3380	-	-	5490	1.62	4761	1.41	5760	1.70	4554	1.35
Greenbush (2025 only)	3380	3380	-	-	-	-	2439	0.72	2619	0.77	2367	0.70

**Note:* *Capacities provided by MBTA*

TABLE D-4
Transit Capacity Analysis: Targeted Growth

	1995 Capacity	2025 Capacity	1995 Demand		2025 Demand Targeted Growth No-Build		2025 Demand Targeted Growth Build 1		2025 Demand Targeted Growth Build 2		2025 Demand Targeted Growth Final Build	
	AM	AM	AM	AM V/C	AM	AM V/C	AM	AM V/C	AM	AM V/C	AM	AM V/C
Rapid Transit												
Blue Line ***into Aquarium***	20,520	25,650	14,900	*0.73*	21,025	*1.02*	21,671	*1.06*	21,745	*1.06*	21,655	*1.06*
Orange Line-North ***into North Station***	23,580	35,370	18,150	*0.77*	24,152	*1.02*	23,450	*0.99*	24,198	*1.03*	23,209	*0.98*
Orange Line-South ***into Mass Ave***	23,580	35,370	16,900	*0.72*	32,705	*1.39*	28,002	*1.19*	30,752	*1.30*	27,704	*1.17*
Red Line-North ***into Charles/MGH***	29,160	43,740	18,800	*0.64*	27,911	*0.96*	26,543	*0.91*	29,435	*1.01*	26,293	*0.90*
Red Line-South ***into Broadway***	29,160	43,740	24,500	*0.84*	44,201	*1.52*	30,705	*1.05*	30,224	*1.04*	30,720	*1.05*
Green Line-West ***into Arlington***	19,800	29,700	26,800	*1.35*	33,735	*1.14*	37,209	*1.25*	35,274	*1.19*	36,721	*1.24*
Green Line-East ***into Govt Center***	19,800	29,700	21,900	*1.11*	25,724	*0.87*	27,633	*0.93*	27,138	*0.91*	26,662	*0.90*
Commuter Rail	**1995 Peak Direction Capacity**	**2025 Peak Direction Capacity**										
Rockport/Ipswich/Newburyport	5,594	5,594	4,545	*0.81*	8,757	*1.57*	8,973	*1.60*	11,331	*2.03*	8,298	*1.48*
Haverhill/Reading	3,729	3,729	2,700	*0.72*	7,758	*2.08*	7,443	*2.00*	8,154	*2.19*	7,326	*1.96*
Lowell	3,108	3,108	2,727	*0.88*	7,767	*2.50*	7,218	*2.32*	7,893	*2.54*	7,227	*2.33*
Fitchburg	3,108	3,108	2,457	*0.79*	7,245	*2.33*	7,074	*2.28*	6,741	*2.17*	7,290	*2.35*
Framingham	6,760	6,760	3,915	*0.58*	7,830	*1.16*	7,533	*1.11*	7,821	*1.16*	7,704	*1.14*
Needham	4,225	4,225	2,745	*0.65*	3,177	*0.75*	2,898	*0.69*	2,943	*0.70*	2,934	*0.69*
Franklin	5,070	5,070	5,067	*1.00*	9,900	*1.95*	9,495	*1.87*	9,711	*1.92*	9,648	*1.90*
Attleboro/Stoughton	8,450	8,450	9,027	*1.07*	13,383	*1.58*	13,059	*1.55*	13,266	*1.57*	12,735	*1.51*
Fairmount	5,915	5,915	1,035	*0.17*	1,323	*0.22*	3,510	*0.59*	3,438	*0.58*	3,285	*0.56*
Middleboro (2025 only)	3,380	3,380	-	-	4,626	*1.37*	4,365	*1.29*	4,824	*1.43*	4,329	*1.28*
Plymouth (2025 only)	3,380	3,380	-	-	5,625	*1.66*	4,842	*1.43*	5,814	*1.72*	4,563	*1.35*
Greenbush (2025 only)	3,380	3,380	-	-	-	-	2,511	*0.74*	2,700	*0.80*	2,475	*0.73*

**Note: Capacities provided by MBTA*

TABLE D-5
Summary of Drive Access Transit Model Results

		2025 Basic Forecast				2025 Targeted Growth			
	1995	NoBuild	Build 1	Build 2	Build 3	NoBuild	Build 1	Build 2	Final
Drive Access Passengers	134,460	237,442	238,566	255,387	235,274	237,344	239,789	257,156	236,440
Drive Access Vehicle Trips	196,065	346,230	348,813	370,713	343,831	346,634	351,106	373,863	346,439
Drive Access Parking Demand	50,118	88,504	88,695	95,599	87,512	88,335	89,027	96,121	87,726
Drive Access Parking Capacity	39,381	51,171	58,614	73,410	60,489	51,171	58,614	73,410	58,332
Ratio of Demand to Capacity	1.27	1.73	1.51	1.3	1.45	1.73	1.52	1.31	1.5

TABLE D-3
Traffic Volume and Volume/Capacity Ratios Along Major Highways: Targeted Growth Scenario, PM PEAK

Roadway	Location	Town	Future Improvement	1995 PMPK	1995 V/C	2025 NB PMPK	NB V/C	B1 PMPK	B1 V/C	B2 PMPK	B2 V/C	Final Build AMPK	Final Build V/C	
Rte 20	W. of I-95	Marlborough		3,990	0.97	4,827	1.24	5,365	1.34	4,769	1.32	4,859	1.34	
Rte 24	North of Intchange 18 (Rte 27)	Brockton		27,110	1.05	31,629	1.31	31,647	1.31	31,379	1.30	31,703	1.31	
Rte 27	N. of Zions Ln	Sherborn		5,112	1.14	6,344	1.60	6,323	1.60	6,399	1.62	6,283	1.58	
Rte 27	N. of Rte 2A	Acton		2,157	0.44	2,840	0.56	2,785	0.53	2,759	0.53	2,818	0.55	
Rte 28	Avon TL	Randolph		4,898	1.02	5,548	1.22	5,451	1.20	5,515	1.22	5,477	1.21	
Rte 28	Reading TL	Stoneham		8,255	0.99	9,904	1.24	10,006	1.31	10,039	1.27	10,133	1.32	
Rte 30	W. of Valley Rd.	Southborough		2,948	0.79	4,328	1.18	4,273	1.19	4,234	1.17	4,257	1.16	
Rte 37	S. of Partridge Hill Rd.	Braintree		3,560	0.80	3,818	0.92	3,843	0.93	3,761	0.89	3,828	0.93	
Rte 38	Tewksbury TL	Wilmington		2,810	0.80	4,065	1.17	3,939	1.13	3,990	1.16	3,980	1.14	
Rte 38	Medford CL	Somerville		8,383	1.04	9,893	1.26	9,825	1.25	9,888	1.26	9,879	1.25	
Rte 53	**Mill St. to Pond St.**	**Hanover**	**Widen to 5-lanes - Bd 1,3,SA**	**2,411**	**0.59**	**2,788**	**0.79**	**2,872**	**0.39**	**2,726**	**0.77**	**2,899**	**0.39**	•
Rte 53/228	**Near Norwell TL**	**Hingham**	**Add ctr turn lane - Bd 1,3,SA**	**3,228**	**0.69**	**3,945**	**0.89**	**3,957**	**0.75**	**3,697**	**0.84**	**4,013**	**0.76**	•
Rte 85	Hopkinton TL	Milford		1,591	0.40	2,559	0.68	2,477	0.66	2,506	0.66	2,496	0.66	
Rte 99	Btw Central St & Summit St	Malden		3,496	0.48	4,602	0.64	4,202	0.56	4,686	0.64	4,177	0.57	
Rte 109	Millis TL	Medway		3,804	0.79	4,387	0.99	4,362	0.98	4,384	0.98	4,356	0.98	
Rte 114	**Watson Pkwy to RR Bridge**	**Danvers**	**Widen 1 to 2 lanes - Bd 1,3,SA**	**6,063**	**0.59**	**7,101**	**0.71**	**7,235**	**0.50**	**7,001**	**0.70**	**7,278**	**0.51**	•
Rte 117	S. of East End Rd.	Bolton		2,082	0.50	3,446	0.83	3,509	0.83	3,520	0.84	3,453	0.83	
Rte 123	Hanover TL	Rockland		4,012	0.80	4,481	0.95	4,052	0.90	4,335	0.91	4,142	0.90	
Rte 126	**North of Rte 135**	**Framingham**	**Grade separation - Bd 1,2,SA**	**5,572**	**1.79**	**6,207**	**2.05**	**6,691**	**1.34**	**6,674**	**1.27**	**6,697**	**1.34**	•
Rte 126	S. of South Main St.	Bellingham		3,178	0.86	4,395	1.19	4,434	1.20	4,394	1.18	4,437	1.20	
Rte 128	**Lynnfield TL**	**Peabody**	**Add 1 lane each dir - Bd 3,SA**	**32,632**	**1.15**	**38,181**	**1.41**	**38,316**	**1.40**	**38,136**	**1.39**	**46,980**	**1.29**	•
Rte 128	**Danvers TL**	**Beverly**	**Add 1 lane each dir - Bd 3,SA**	**19,540**	**1.03**	**21,817**	**1.17**	**21,681**	**1.16**	**21,586**	**1.15**	**26,107**	**0.96**	•
Rte 129	N. of Water St.	Wakefield		2,741	0.93	3,306	1.09	2,945	0.93	3,106	0.97	3,169	1.02	

Note: Bullet (•) and shading indicate future year highway improvement along the segment

TABLE D-5 (CONT.)
Detailed Summary of Drive Access Transit Model Results

	1995 Survey			2025 Basic Forecast											
				No-build			Build 1			Build 2			Build 3		
	Parking Usage	Parking Capacity	Ratio	Parking Demand	Parking Capacity	Ratio	Parking Demand	Parking Capacity	Ratio	Parking Demand	Parking Capacity	Ratio	Parking Demand	Parking Capacity	Ratio
	32,966	**39,381**	**0.84**	**88,504**	**51,171**	**1.73**	**88,695**	**58,614**	**1.51**	**95,599**	**73,410**	**1.3**	**87,512**	**60,489**	**1.45**
ROCKP/IPSW/NWBRYP	2,224	2,998	0.74	6,160	4,137	1.49	6,055	4,537	1.33	6,913	5,278	1.31	5,719	5,288	1.08
HAVERHILL	1,339	1,926	0.7	4,405	1,926	2.29	4,208	2,176	1.93	4,515	3,600	1.25	4,111	1,926	2.13
LOWELL	1,597	2,173	0.73	6,334	4,410	1.44	6,216	4,860	1.28	6,256	5,584	1.12	6,146	4,410	1.39
FRAMINGHAM/WORC	1,767	2,166	0.82	5,787	2,957	1.96	5,507	2,957	1.86	5,695	3,625	1.57	5,386	3,104	1.74
FITCHBURG	1,153	1,273	0.91	6,576	1,332	4.94	6,517	1,332	4.89	6,229	1,384	4.5	6,465	2,233	2.9
NEEDHAM	1,185	1,506	0.79	1,801	1,506	1.2	2,127	1,506	1.41	1,916	1,793	1.07	2,155	1,506	1.43
FRANKLIN	2,677	3,347	0.8	8,009	3,649	2.19	7,817	3,949	1.98	8,028	4,881	1.64	8,118	6,433	1.26
PROV/STOUGH/FAIRM	5,780	6,018	0.96	7,682	6,994	1.1	7,696	8,498	0.91	7,941	10,518	0.76	7,346	6,994	1.05
MIDDLEBOROUGH	0	0		4,306	2,269	1.9	4,069	2,569	1.58	4,377	4,527	0.97	4,068	2,475	1.64
PLYMOUTH	0	0		5,486	2,968	1.85	4,658	3,078	1.51	5,536	3,004	1.84	4,556	2,968	1.54
GREENBUSH	0	0		0	0		2,397	2,929	0.82	2,610	3,458	0.75	2,292	2,929	0.78
BLUE	1,989	2,152	0.92	3,492	2,152	1.62	3,684	2,152	1.71	2,766	2,752	1.01	3,641	2,152	1.69
ORANGE	2,755	2,512	1.1	5,468	3,462	1.58	4,507	3,462	1.3	3,322	4,011	0.83	4,405	3,462	1.27
MATTAPAN	85	302	0.28	1,667	302	5.52	1,670	302	5.53	1,535	302	5.08	1,656	302	5.48
RED	8,420	8,427	1	11,981	8,526	1.41	10,218	8,526	1.2	8,232	8,621	0.95	10,238	8,526	1.2
GREEN	1,995	2,128	0.94	7,537	2,128	3.54	10,205	3,328	3.07	7,227	4,019	1.8	10,068	3,328	3.03
BUS AND BOAT	NA	2,453		1,812	2,453	0.74	1,146	2,453	0.47	1,172	2,453	0.48	1,140	2,453	0.46
URBAN RING PHASE 2	0	0		0	0		0	0		11,330	3,600	3.15	0	0	

Table D-5 (Cont.)
Detailed Summary of Drive Access Transit Model Results

2025 Targeted Growth

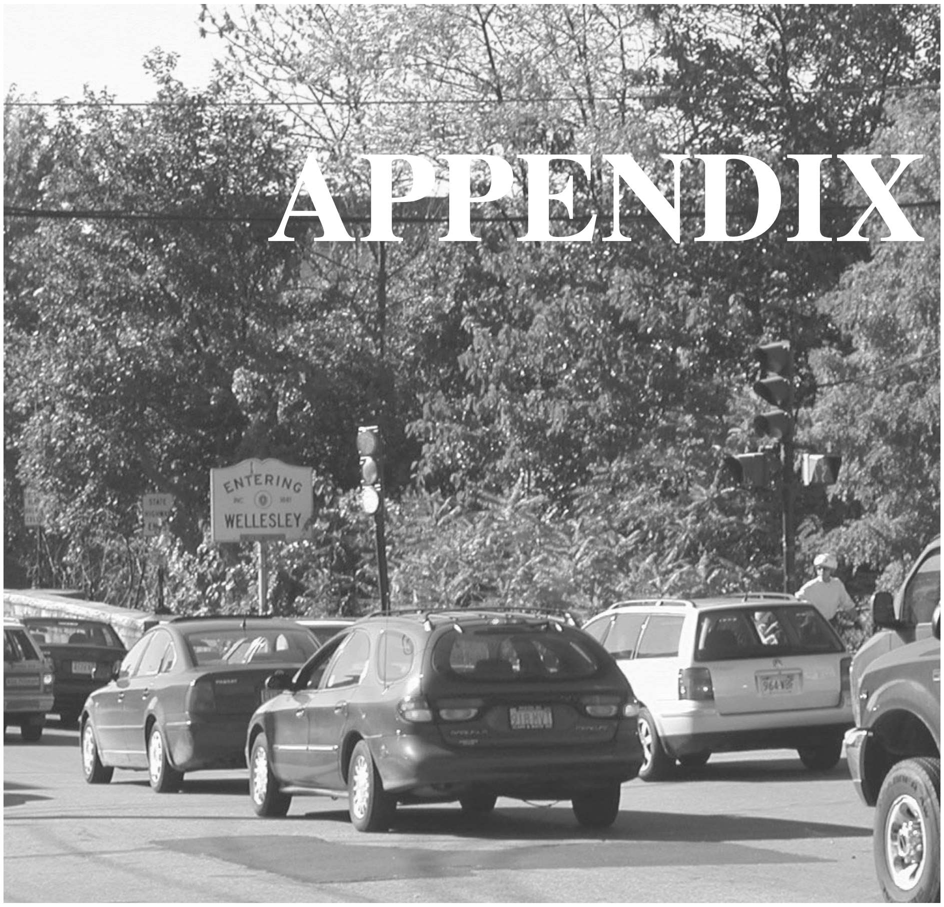
	No-build			Build 1			Build 2			Final Build		
	Parking Demand	Parking Capacity	Ratio	Parking Demand	Parking Capacity	Ratio	Parking Demand	Parking Capacity	Ratio	Parking Demand	Parking Capacity	Ratio
	88,335	**51,171**	**1.73**	**89,027**	**58,614**	**1.52**	**96,121**	**73,410**	**1.31**	**87,726**	**58,332**	**1.5**
ROCKP/IPSW/NWBRYP	6,322	4,137	1.53	6,231	4,537	1.37	7,097	5,278	1.34	5,921	4,758	1.24
HAVERHILL	4,077	1,926	2.12	3,927	2,176	1.8	4,196	3,600	1.17	4,065	1,926	2.11
LOWELL	6,094	4,410	1.38	6,017	4,860	1.24	6,020	5,584	1.08	5,714	4,604	1.24
FRAMINGHAM/WORC	5,397	2,957	1.83	5,170	2,957	1.75	5,342	3,625	1.47	5,285	3,451	1.53
FITCHBURG	6,134	1,332	4.61	6,008	1,332	4.51	5,742	1,384	4.15	6,154	1,332	4.62
NEEDHAM	1,922	1,506	1.28	2,275	1,506	1.51	2,055	1,793	1.15	2,273	1,506	1.51
FRANKLIN	7,457	3,649	2.04	7,244	3,949	1.83	7,457	4,881	1.53	7,329	3,949	1.86
PROV/STOUGH/FAIRM	7,457	6,994	1.07	7,473	8,498	0.88	7,680	10,518	0.73	7,098	6,994	1.01
MIDDLEBOROUGH	4,285	2,269	1.89	4,073	2,569	1.59	4,418	4,527	0.98	4,015	3,069	1.31
PLYMOUTH	5,522	2,968	1.86	4,734	3,078	1.54	5,578	3,004	1.86	4,502	3,378	1.33
GREENBUSH	0	0		2,510	2,929	0.86	2,739	3,458	0.79	2,391	2,929	0.82
BLUE	3,716	2,152	1.73	3,941	2,152	1.83	2,993	2,752	1.09	3,849	2,152	1.79
ORANGE	5,778	3,462	1.67	4,763	3,462	1.38	3,628	4,011	0.9	4,675	3,462	1.35
MATTAPAN	1,777	302	5.88	1,792	302	5.93	1,661	302	5.5	1,775	302	5.88
RED	12,787	8,526	1.5	10,997	8,526	1.29	8,897	8,621	1.03	11,022	8,637	1.28
GREEN	7,754	2,128	3.64	10,751	3,328	3.23	7,687	4,019	1.91	10,586	3,430	3.09
BUS AND BOAT	1,856	2,453	0.76	1,121	2,453	0.46	1,164	2,453	0.47	1,074	2,453	0.44
URBAN RING PHASE 2	0	0		0	0		11,768	3,600	3.27	0	0	

Table D-6
Travel Model Results

	BASIC FORECAST SCENARIO								
Socioeconomic and Transportation Measures	1995	NO-BUILD		BUILD 1		BUILD 2		BUILD 3	
			% Growth		% Change		% Change		% Change
	Base Year	No-Build	1995 to 2025NB	Build 1	NB to B1	Build 2	NB to B2	Build 3	NB to B3
Population	4,160,100	4,765,100	15%	4,765,100		4,765,100		4,765,100	
Households	1,544,100	1,893,100	23%	1,893,100		1,893,100		1,893,100	
Employment	2,133,900	2,799,400	31%	2,799,400		2,799,400		2,799,400	
Person Trips(Weekday)									
Total intraregional trips	14,179,800	17,357,600	22%	17,357,400		17,357,400		17,357,400	
Total linked transit trips	776,100	1,145,300	48%	1,156,900	1.01%	1,185,000	3.47%	1,175,200	2.61%
Total walk trips	2,232,100	3,013,600	35%	2,999,500	-0.47%	2,994,700	-0.63%	2,988,800	-0.82%
Intraregional auto trips	11,171,600	13,198,700	18%	13,201,000	0.02%	13,177,700	-0.16%	13,193,400	-0.04%
Intraregional transit mode share	5.47%	6.60%		6.67%		6.83%		6.77%	
Transit boardings (Weekday)									
Total commuter rail	93,400	231,000	147%	241,600	4.59%	258,600	11.95%	236,100	2.21%
Total rapid transit lines	676,500	1,056,500	56%	986,400	-6.64%	990,300	-6.27%	978,900	-7.35%
Total local buses	365,600	530,600	45%	592,800	11.72%	653,300	23.12%	634,400	19.56%
Total express buses	35,000	46,300	32%	49,400	6.70%	44,200	-4.54%	45,900	-0.86%
Total transit boardings	1,170,500	1,864,400	59%	1,870,200	0.31%	1,946,400	4.40%	1,895,300	1.66%
Transfer ratio	151%	163%		162%		164%		161%	
Highway Statistics (Weekday)									
Total assigned vehicle trips	10,463,800	13,011,300	24%	13,022,400	0.09%	13,015,900	0.04%	13,018,300	0.05%
Total vehicle miles traveled	106,166,600	142,719,500	34%	142,877,000	0.11%	142,567,000	-0.11%	143,023,600	0.21%
Total vehicle hours traveled	3,253,800	4,807,200	48%	4,766,300	-0.85%	4,776,400	-0.64%	4,754,700	-1.09%
Average vehicle speed (MPH)	32.6	29.7	-9%	30	1.01%	29.8	0.34%	30.1	1.35%
Average vehicle trip length (miles)	10.1	11.0	8%	11.0	0.03%	11.0	-0.14%	11.0	0.16%

TABLE D-6
Travel Model Results

	TARGETED GROWTH SCENARIO									
Socioeconomic and Transportation Measures	1995		NO - BUILD		BUILD 1		BUILD 2		FINAL BUILD	
			% Growth	Change in NB		% Change		% Change		% Change
	Base Year	No-Build	1995 to 2025NB	Sce. C - Sce. A	Build 1	NB to B1	Build 2	NB to B2	FNL Build	NB to FNL BLD
Population	4,160,100	4,834,000	16%	68,900	4,834,000		4,834,000		4,834,000	
Households	1,544,100	1,927,400	25%	34,300	1,927,400		1,927,400		1,927,400	
Employment	2,133,900	2,799,700	31%	300	2,799,700		2,799,700		2,799,700	
Person Trips(Weekday)										
Total intraregional trips	14,179,800	17,542,900	24%	185,300	17,542,900		17,542,900		17,542,900	
Total linked transit trips	776,100	1,225,300	58%	80,000	1,252,000	2.18%	1,281,100	4.55%	1,263,400	3.11%
Total walk trips	2,232,100	3,195,000	43%	181,400	3,172,500	-0.70%	3,167,300	-0.87%	3,165,900	-0.91%
Intraregional auto trips	11,171,600	13,122,600	17%	-76,100	13,118,400	-0.03%	13,094,500	-0.21%	13,113,600	-0.07%
Intraregional transit mode share	5.47%	6.98%			7.14%		7.30%		7.20%	
Transit boardings (Weekday)										
Total commuter rail	93,400	231,700	148%	700	244,700	5.61%	261,900	13.03%	238,000	2.72%
Total rapid transit lines	676,500	1,134,000	68%	77,500	1,074,800	-5.22%	1,079,000	-4.85%	1,032,500	-8.95%
Total local buses	365,600	572,600	57%	42,000	649,400	13.41%	712,400	24.41%	719,000	25.57%
Total express buses	35,000	50,400	44%	4,100	53,900	6.94%	48,400	-3.97%	53,600	6.35%
Total transit boardings	1,170,500	1,988,700	70%	124,300	2,022,800	1.71%	2,101,700	5.68%	2,043,100	2.74%
Transfer ratio	151%	162%			162%		164%		162%	
Highway Statistics (Weekday)										
Total assigned vehicle trips	10,463,800	12,936,700	24%	-74,600	12,942,200	0.04%	12,938,100	0.01%	12,942,100	0.04%
Total vehicle miles traveled	106,166,600	140,170,300	32%	-2,549,200	140,268,000	0.07%	139,947,300	-0.16%	140,510,900	0.24%
Total vehicle hours traveled	3,253,800	4,691,300	44%	-115,900	4,645,000	-0.99%	4,653,100	-0.81%	4,639,700	-1.10%
Average vehicle speed (MPH)	32.6	29.9	-8%	20.00%	30.2	1.00%	30.1	0.67%	30.3	1.34%
Average vehicle trip length (miles)	10.1	10.8	7%	-13.38%	10.8	0.03%	10.8	-0.17%	10.9	0.20%



APPENDIX E

ALTERNATIVE PROJECT LISTS TESTED WITH THE TRANSPORTATION MODEL

The results of the regional travel demand model are one of the inputs used by the MPO to determine the merits of possible projects. Before selecting the final set of recommended projects, the MPO developed three transportation project lists for modeling.

Alternative One segregated funding by use; highway revenues were used exclusively for highway projects and transit revenues were used for transit projects. Highway projects were selected on the basis of regional needs, while trying to provide geographic equity. Transit projects were selected to maintain legal commitments and make improvements to the existing system.

Alternative Two was based on an attempt to target growth, combined with an underlying policy that projects that increase highway capacity should be undertaken only if no other feasible option is available. Highway projects were selected based upon location and their use in channeling growth to desired locations. Transit projects were selected to maintain legal commitments and to channel growth to desired locations. In this alternative, $430,100,000 in highway funds was assumed to be flexed to transit projects over 25 years.

Alternative Three was developed to provide model results for some high-interest projects that had not been included in either of the two previous alternatives. Six additional highway projects were selected based upon public input, future year model forecasts, and agency recommendations. Two additional transit projects were included based, in large part, upon the recommendations of the MPO Environmental Justice Ad Hoc Committee.

Alternative 1 Transportation Network

30% Non-Artery Highway Capital Program yields:	**$1,491,456,000**
***less* No-Build project:**	**$0**
Available Non-Artery Highway Funding:	**$1,491,456,000**

Bedford	Crosby Dr.	$3,500,000
Bedford & Burlington	Middlesex Turnpike	$9,000,000
Boston	East Boston Haul Rd.	$12,000,000
Boston	Rte. 1A/Boardman St. Grade Separation	$8,500,000
Boston	Rutherford Ave.	$50,000,000
Boston & Chelsea	Rte. 1A/Chelsea St. Bridge Connection	$34,800,000
Boston to Newton	Double Stack Initiative	$40,000,000
Cambridge	Mass. Ave./Lafayette Sq.	$4,400,000
Cambridge	Cambridgeport Roadways	$3,000,000
Canton	I-93/I-95 Interchange	$27,500,000
Canton	I-95 (NB)/Dedham St. Ramp	$3,000,000
Canton	I-95 (SB)/Dedham St. Onramp	$1,200,000
Concord	Concord Rotary	$35,000,000
Concord & Lincoln	Rte. 2/Crosby's Corner	$17,500,000
Danvers & Peabody	Rte. 1/114 Corridor Improvements	$40,000,000
Everett, Malden & Medford	Telecom City Roadways	$24,900,000
Everett, Medford & Revere	Revere Beach Parkway	$54,000,000
Framingham to Worcester	Double Stack Initiative	$16,000,000
Framingham	Rte. 126/Rte. 135 Grade Separation	$50,000,000
Franklin	Rte. 140	$18,000,000
Hanover	Rte. 53	$4,000,000
Hingham & Norwell	Rte. 53/Rte. 228	$2,500,000
Hingham, Rockland & Weymouth	Naval Air Station Access Improvements	$87,500,000
Hopkinton	I-495/South St. New Interchange	$20,000,000
Hudson & Marlborough	I-495/I-290/Rte. 85 Interchange	$25,000,000
Littleton	Rte. 2 Interchange	$10,000,000
Malden & Revere	Rte. 1 Improvements	$33,600,000
Marlborough	Rte. 20, Segments 2 & 3	$7,200,000
Natick & Wellesley	Double Stack Initiative	$40,000,000
Needham & Newton	Needham St. (Highland Ave.)	$6,600,000
Quincy	Quincy Center Concourse, Phase 2	$6,000,000
Randolph to Wellesley	Rte. 128 Additional Lanes	$97,000,000
Reading & Wilmington	I-93/Rte. 129 Interchange	$15,000,000
Reading & Woburn	I-93/I-95 Interchange	$75,000,000
Revere	Mahoney Circle Grade Separation	$25,000,000
Revere	Rte. 1/Rte. 16 Interchange	$3,900,000
Revere	Rte. 1A/Rte. 16 Connection	$39,600,000

Alternative 1 Transportation Network

30% Non-Artery Highway Capital Program yields:	**$1,491,456,000**
***less* No-Build project:**	**$0**
Available Non-Artery Highway Funding:	**$1,491,456,000**

Salem	Boston St.	$2,000,000
Salem	Bridge St.	$3,000,000
Salem	Bridge St. Bypass	$12,300,000
Somerville	I-93/Mystic Ave. Interchange	$50,000,000
Weymouth	Rte. 18	$15,000,000
Weymouth to Duxbury	Rte. 3 South Additional Lanes	$180,000,000
Wilmington	I-93/Ballardvale St. Interchange	$15,000,000
		$1,227,500,000
Regionwide	Associated Costs (Engineering, Right-of-way, etc.)	$245,500,000
		$1,473,000,000

Alternative 1 Transportation Network

30% Transit Capital Program yields:	**$2,534,000,000**
less **No-Build projects (SBP & Silver Line):**	**$339,000,000**
Available Transit Capital Funding:	**$2,195,000,000**

Boston	Arborway Green Line	$59,000,000
Boston	Fairmount Branch Improvements	$29,600,000
Boston	Russia Wharf Ferry Terminal	$5,000,000
Boston	Red Line/Blue Line Connector	$220,000,000
Boston to New Bedford	New Bedford/Fall River Commuter Rail	$610,000,000
Boston to Scituate	Greenbush Commuter Rail	$400,000,000
Boston, Medford & Somerville	Medford Hillside Green Line	$375,000,000
Boston[1]	Silver Line, Phase B	$713,000,000
Inner Core	Urban Ring, Phase 1	$100,000,000
Littleton	New Commuter Rail Station	$4,000,000
Regionwide	Capacity/Frequency Improvements	$35,900,000
		$2,195,000,000

[1] Only 50% of this project's costs ($356.5 milllion) are chargeable to MBTA revenues; the rest will be pursued at the federal level via New Start funding.

Alternative 2 Transportation Network

Highway Component

30% Non-Artery Highway Capital Program yields:	**$1,491,456,000**
***less* No-Build projects:**	**$0**
Available Non-Artery Highway Funding:	**$1,491,456,000**

Boston	East Boston Haul Rd.	$12,000,000
Boston	Rte. 1A/Boardman St. Grade Separation	$8,500,000
Boston	Rutherford Ave.	$50,000,000
Boston & Chelsea	Rte. 1A/Chelsea St. Bridge Connection	$34,800,000
Boston to Newton	Double Stack Initiative	$40,000,000
Cambridge	Mass. Ave./Lafayette Sq.	$4,400,000
Cambridge	Cambridgeport Roadways	$3,000,000
Canton	I-95 (SB)/Dedham St. Onramp	$1,200,000
Everett, Malden & Medford	Telecom City Roadways	$24,900,000
Everett, Medford & Revere	Revere Beach Parkway	$54,000,000
Framingham to Worcester	Double Stack Initiative	$16,000,000
Framingham	Rte. 126/Rte. 135 Grade Separation	$50,000,000
Franklin	Route 140	$18,000,000
Marlborough	Rte. 20, Segments 2 & 3	$7,200,000
Natick & Wellesley	Double Stack Initiative	$40,000,000
Needham & Newton	Needham St. (Highland Ave.)	$6,600,000
Quincy	Quincy Center Concourse, Phase 2	$6,000,000
Revere	Mahoney Circle Grade Separation	$25,000,000
Revere	Rte. 1/Rte. 16 Interchange	$3,900,000
Revere	Rte. 1A/Rte. 16 Connection	$39,600,000
Salem	Boston St.	$2,000,000
Salem	Bridge St.	$3,000,000
Salem	Bridge St. Bypass	$12,300,000
Somerville	I-93/Mystic Ave. Interchange	$50,000,000
		$512,400,000
Regionwide	Associated Costs (Engineering, Right-of-way, etc.)	$102,480,000
	Total Highway Spending on Alternative Two Network:	**$614,880,000**

Available Non-Artery Highway Funding:	$1,491,456,000
less Highway Spending on Alternative Two Network:	$614,880,000
Remaining Highway Funds:	**$876,576,000**

Note: All highway projects in the Alternative Two network were also in Alternative One. However, several projects from Alternative One were omitted from this network. Those projects are Crosby Drive (Bedford), Middlesex Turnpike (Bedford & Burlington), I-93/I-95 Interchange (Canton), I-95 (NB)/Dedham St. (Canton), Concord Rotary, Route 2/Crosby's Corner (Concord), Route 1/114 Corridor Improvements (Danvers & Peabody), Route 53 (Hanover), Route 53/228 (Hingham & Norwell), Naval Air Station Access Improvements (Hingham, Rockland, Weymouth), I-495/South Street Interchange (Hopkinton), I-495/I-290/Route 85 Interchange (Hudson & Marlborough), Route 2 Interchange(Littleton), Route 1 Improvements (Malden & Revere), Route 128 Additional Lanes (Randolph to Wellesley), I-93/Route 129 Interchange (Reading & Wilmington), I-93/I-95 Interchange (Reading & Woburn), Route 18 (Weymouth), Route 3 South Additional Lanes (Weymouth to Duxbury), and I-93 Ballardvale Street Interchange (Wilmington).

Alternative 2 Transportation Network

Transit Component

30% Transit Capital Program yields:	**$2,534,000,000**
less **No-Build projects (SBP & Silver Line):**	**$339,000,000**
less Funding Allocated to New Bedford/Fall River:	**$610,000,000**
Available Transit Capital Funding:	**$1,585,000,000**

Boston	Arborway Green Line	$59,000,000
Boston	Fairmount Branch Improvements	$29,600,000
Boston	Russia Wharf Ferry Terminal	$5,000,000
Boston	Red Line/Blue Line Connector	$220,000,000
Boston to Scituate	Greenbush Commuter Rail	$400,000,000
Boston, Medford & Somerville	Medford Hillside Green Line	$375,000,000
Boston[1]	Silver Line, Phase B	$713,000,000
Inner Core	Urban Ring, Phase 1	$100,000,000
Inner Core[1]	*Urban Ring, Phase 2*	$500,000,000
Somerville	*Assembly Square Orange Line Station*	$5,000,000
Regionwide	*Transit & Commuter Rail Parking*	$215,000,000
	Subtotal of Transit Project Costs:	**$2,621,600,000**
	less Assumed New Start Grants:	**$606,500,000**
	Total Transit Funding from Revenue Allocated in the 2000 RTP:	**$2,015,100,000**

Available Transit Capital Funding:	$1,585,000,000
less Transit Spending on Alternative Two Network:	$2,015,100,000
Highway Funds Flexed to Transit:	**$430,100,000**

Note: Projects in italics were not included in the Alternative One. Projects included in that network that are not in the Alternative Two network are the New Bedford/Fall River Commuter Rail, New Commuter Station in Littleton, and Regionwide Capacity/Frequency Improvements. Additionally, it has been assumed that the decision not to fund New Bedford/Fall River is a zero-sum game, in that the MBTA will allocate the revenue for the project in the SRPEDD Transportation Plan.

[1] Only 50% of the project's costs are chargeable to MBTA revenues; the rest will be pursued at the federal level via New Start funding.

Alternative 3 Transportation Network

30% Non-Artery Highway Capital Program yields:	**$1,491,456,000**
***less* No-Build project:**	**$0**
Available Non-Artery Highway Funding:	**$1,491,456,000**

Bedford	Crosby Dr.	$3,500,000
Bedford & Burlington	Middlesex Turnpike	$9,000,000
Boston	East Boston Haul Rd.	$12,000,000
Boston	Rte. 1A/Boardman St. Grade Separation	$8,500,000
Beverly to Peabody	Rte. 128 Capacity Improvements	$60,000,000
Boston	Back Bay Turnpike Exit	$100,000,000
Boston & Chelsea	Rte. 1A/Chelsea St. Bridge Connection	$34,800,000
Cambridge	Mass. Ave./Lafayette Sq.	$4,400,000
Cambridge	Cambridgeport Roadways	$3,000,000
Canton	I-93/I-95 Interchange	$27,500,000
Canton	I-95 (NB)/Dedham St. Ramp	$3,000,000
Canton	I-95 (SB)/Dedham St. Onramp	$1,200,000
Concord	Concord Rotary	$35,000,000
Concord & Lincoln	Rte. 2/Crosby's Corner	$17,500,000
Danvers & Peabody	Rte. 1/114 Corridor Improvements	$40,000,000
Everett, Malden & Medford	Telecom City Roadways	$24,900,000
Everett, Medford & Revere	Revere Beach Parkway	$54,000,000
Framingham	Rte. 9/Rte. 126 Interchange	$15,000,000
Franklin	Rte. 140	$18,000,000
Hanover	Rte. 53	$4,000,000
Hingham & Norwell	Rte. 53/Rte. 228	$2,500,000
Hingham, Rockland & Weymouth	Naval Air Station Access Improvements	$87,500,000
Hudson & Marlborough	I-495/I-290/Rte. 85 Interchange	$25,000,000
Lynnfield to Reading	Rte. 128 Capacity Improvements	$50,000,000
Malden & Revere	Rte. 1 Improvements	$33,600,000
Marlborough	Rte. 20, Segments 2 & 3	$7,200,000
Needham & Newton	Needham St. (Highland Ave.)	$6,600,000
Quincy	Burgin Parkway	$18,000,000
Quincy	Quincy Center Concourse, Phase 2	$6,000,000
Randolph to Wellesley	Rte. 128 Additional Lanes	$97,000,000
Reading & Wilmington	I-93/Rte. 129 Interchange	$15,000,000
Reading & Woburn	I-93/I-95 Interchange	$75,000,000
Revere	Mahoney Circle Grade Separation	$25,000,000
Revere	Rte. 1/Rte. 16 Interchange	$3,900,000
Revere	Rte. 1A/Rte. 16 Connection	$39,600,000
Salem	Boston St.	$2,000,000

Alternative 3 Transportation Network

30% Non-Artery Highway Capital Program yields:	**$1,491,456,000**
***less* No-Build project:**	**$0**
Available Non-Artery Highway Funding:	**$1,491,456,000**

Salem	Bridge St.	$3,000,000
Salem	Bridge St. Bypass	$12,300,000
Somerville	I-93/Mystic Ave. Interchange	$50,000,000
Weymouth	Rte. 18	$15,000,000
Weymouth to Duxbury	Rte. 3 South Additional Lanes	$180,000,000
Wilmington	I-93/Ballardvale St. Interchange	$15,000,000
Woburn	New Boston Street Bridge	$2,000,000
		$1,246,500,000
Regionwide	Associated Costs (Engineering, Right-of-way, etc.)	$245,500,000
		$1,492,000,000

Alternative 3 Transportation Network

	30% Transit Capital Program yields:	**$2,534,000,000**
	less **No-Build projects (SBP & Silver Line):**	**$339,000,000**
	Available Transit Capital Funding:	**$2,195,000,000**

Boston	Arborway Green Line	$59,000,000
Boston	Fairmount Branch Improvements	$29,600,000
Boston	Russia Wharf Ferry Terminal	$5,000,000
Boston	Red Line/Blue Line Connector	$193,000,000
Boston	Light Rail on Washington Street	$165,000,000
Boston to New Bedford	New Bedford/Fall River Commuter Rail	$610,000,000
Boston to Scituate	Greenbush Commuter Rail	$400,000,000
Boston, Medford & Somerville	Medford Hillside Green Line	$375,000,000
Boston[1]	Silver Line, Phase B	$600,000,000
Somerville	Assembly Square Orange Line Station	$5,000,000
Regionwide	New MBTA Buses	$35,000,000
Regionwide	Transit & Commuter Rail Parking	$78,000,000
	Subtotal of Transit Project Costs:	**$2,554,600,000**
	less Assumed New Start Grants:	**$360,000,000**
	Total Transit Funding from Revenue Allocated in the 2000 RTP:	**$2,194,600,000**

[1] Only 40% of this project's costs ($240 milllion) are chargeable to MBTA revenues; the rest will be pursued at the federal level via New Start funding.

APPENDIX F

DESCRIPTIONS OF PROJECTS INCLUDED IN THE TRANSPORTATION PLAN

1995 Base Case Projects

Highway Projects

Route 53, Phase I (Hanover): Widening of Route 53 from Route 3 to Mill Street (Hanover) was completed by MHD in 1994. This project widened Route 53 from a two-lane to a five-lane roadway segment.

HOV Lane on I-93 (Mystic Avenue): This MHD project is an extension of the existing southbound HOV lane to the Sullivan Square (Somerville) off-ramp. The HOV lane is for vehicles with two or more occupants and is a total of 2.03 miles in length. The extension was opened in September 1994.

HOV Lane on the Southeast Expressway: This six-mile HOV lane is between Furnace Brook Parkway (Quincy) and Freeport Street (Dorchester-Boston). The facility opened in November 1995. It uses contra-flow technology, in which a travel lane is reallocated from the off-peak side of the expressway to the peak side for the duration of the peak period. Originally the HOV lane was for vehicles with 3 or more persons. This does not include the revision to the occupancy rate, which was reduced to 2 or more persons via a sticker program and then later instituted as 2 or more by right in 1999.

Ted Williams Tunnel: The Ted Williams Tunnel (aka/ Third Harbor Tunnel) extends 1.6 miles (.75 miles under water) from South Boston (Boston) to Logan Airport property (East Boston). It opened for commercial traffic only on December 15,1995. The approximate cost for the tunnel was $1.5 billion. The 1995 base case does not include the provision for general-purpose use of the tunnel on weekends instituted in fall 1996.

South Boston Bypass Road (aka/Haul Road): The roadway segment runs from the Ted Williams Tunnel (South Boston) to near the I-93/Massachusetts Avenue interchange (Boston). The roadway is restricted to commercial vehicles only. It was opened in July 1993. This roadway project is part of the

Central Artery project. This does not include the completed interchange between the Bypass road and I-93.

Transit Projects

Urban Ring bus service: This MBTA circumferential bus service was begun in 1994. It consists of three limited stop bus routes providing connections among the Red Line, the Orange Line and the Green Line branches. The three services are:

- CT1: Central Square (Cambridge) to B.U. Medical Center (Boston)
- CT2: Kendall Square (Cambridge) to Ruggles Station (Boston) via Longwood Medical area. The service extension to Sullivan Square begun in 2000 is included in the 2025 No-build scenario.
- CT3: Andrew Station (South Boston) to Longwood Medical area (Boston) via Ruggles Station. The service extension of the CT3 to Logan Airport instituted by the MBTA in September 1999 is included in the 2025 No-build scenario.

Worcester Commuter Rail, Partial Service: This MBTA commuter rail service from Framingham station to Worcester station with no intermediate stops began in September, 1994. This includes four inbound trains from Worcester in the morning and 1 in the afternoon and four outbound trains from Framingham in the afternoon and 1 in the evening. This service does not include any of the proposed station stops to be built as part of the full service. The Grafton Station was opened in February, 2000.

Additional Park and Ride Spaces: These are the new parking spaces added between January 1, 1991 and December 31, 1995. Parking spaces were added at eleven commuter rail stations, including Needham Heights, Worcester, Lowell, Lynn, Readville and West Concord.

South Station Transportation Center: This MBTA improvement is the intercity bus terminal above the commuter rail tracks and platforms at South Station. The facility was opened in October 1995. The facility serves intercity bus carriers, major regional carriers and commuter bus operators. The bus concourse has 23 sawtooth docks, four pull-through docks and two airport link docks. This does not include a pedestrian connector between the bus station and the railway station.

2025 No-Build Projects

Highway Projects

Central Artery: The Central Artery/Tunnel project is the largest, most complex and technologically challenging highway project in American history. The estimated cost of the project is $14 billion with a final completion date estimated at December 2004. This Massachusetts Turnpike Authority project is highlighted by the construction of an 8-to-10 lane, limited access, 1.5 mile underground expressway to replace the existing elevated I-93 highway. Other components of the project are the Ted Williams Tunnel from South Boston to Logan Airport, an extension of I-90 from near South Station to Logan Airport and Route 1A in East Boston, four major highway interchanges, a cable-stayed bridge across the Charles River, and the reconstruction of an additional 2.1 mile segment of I-93. In all the project is building or rebuilding 161 lane miles of urban highway, about half in tunnels, in a 7.5 mile corridor. Approximate completion dates are:

- Ted Williams Tunnel (opened December 15, 1995-included in 1995 Base Case)
- South Boston Bypass Road (opened 1993-included in 1995 Base Case)
- Charlestown/Leverett Circle Bridge (opened October 7, 1999)
- I-90 Extension to the Ted Williams Tunnel (approximately September 2002)
- I-93 Northbound (approximately November 2002)
- I-93 Southbound (approximately November 2003)

- Project completion (approximately December 2004)

Beverly Salem Bridge: Replace a drawbridge over the Danvers River/ Beverly Harbor connecting the cities of Beverly and Salem with an elevated fixed structure. The 2025 No-Build Scenario does not include the final two phases of the Beverly/Salem Bridge project – the construction of the Bridge Street Bypass Road and the widening of Bridge Street from Flint Street to beyond the Washington Street Rotary. The bridge opened for traffic on August 2, 1996.

Blue Hill Avenue Signal Coordination: This MassHighway project involved the coordination of signals along the Blue Hill Avenue corridor in Boston.

Brighton Avenue Signal Coordination: This MassHighway project involved the coordination of signals along the Brighton Avenue corridor in Boston.

Route 139 (Marshfield): This MassHighway project consisted of the reconstruction, widening and installation of traffic signals on Route 139 in Marshfield from the Route 3 off-ramp to the Pembroke town line.

Route 20, Segment 1 (Marlborough): Widen a 1.1-mile section of Route 20 from 2 lanes to 4 lanes. The project extends from just west of Farm Road to the Raytheon traffic lights just east of DiCenzo Boulevard. The project includes the replacement of traffic signals at the intersection of Route 20 and Farm Road & Wilson Street, the installation of traffic signals at DiCenzo Boulevard (West), and the coordination of these two signals and existing signals at Hager Street and Raytheon Company Drive. This project opened to traffic in October 1999.

I-495 interchange (Marlborough/Southborough): Construct an interchange to Interstate 495 between Route 9 and Route 20. Major elements of the work include the construction of four entrance/exit ramps for I-495 with two bridges and a connector road from the ramps to Crane Meadow Road, as well as the reconstruction and signalization of Crane Meadow Road. This project was advertised in September 1998 and work is ongoing.

I-93/Industriplex interchange (Woburn): Construct an interchange to Interstate 93 between Interstate 95 and Route 129. Major elements of the work include the construction of four entrance/exit ramps for I-93 with two bridges and a connector road from the ramps to Commerce Way, as well as the reconstruction and signalization of the Commerce Way intersection. This project was advertised in June 1997 and was opened to traffic in October 2000.

Quincy Center Concourse, Phase I: Construct the Quincy Center Concourse Bridge connecting Burgin Parkway to Parkin Way. The work also includes the reconstruction of sections of Burgin Parkway, the Granite Street Connector, and Parkin Way, including the installation of an interconnected traffic signal system. The 2025 No-Build Scenario does not include the final two phases of the Quincy Center Concourse project – the connection of Burgin Parkway to Hancock Street (the Westside Link) and the connection of Hancock Street to Mechanic Street/ Revere Road (the Eastside Link). This project was advertised in October 1998.

Route 62 and Middlesex Turnpike: Make traffic safety improvements to Route 62 between the Route 3 overpass and Network Drive (formerly Kent Road) and to Middlesex Turnpike from Lexington Street to Terrace Hall Avenue and Network Drive. The improvements to Route 62 include the installation of a traffic signal and the reconstruction of two others, the widening of the roadway from two to four lanes, and the installation of a sidewalk along one side of the roadway. Work on Middlesex Turnpike includes the installation of two traffic signals and the reconstruction of two others, the widening of the roadway from two to four lanes and an additional left turn lane at three separate locations, and the installation of a sidewalk along one side of the roadway.

Route 9 (Wellesley): Widen Route 9 from 4 lanes to 6 lanes from Willow Street to the Interstate 95 (Route 128) northbound on-ramp. This

project was advertised in July 1999 and completed in 2000.

Marrett Road Signal Coordination: This MassHighway project consists of reconstructing Route 2A (Marrett Road) from I-95 (Route 128) west to beyond the Massachusetts Avenue extension.

Route 138 (Canton): Widen Route 138 from 2 lanes to 4 lanes from the Route 128 Interchange (the northern limit of the Washington Street Bridge) to 200 meters north of the intersection of Route 138 and Royall Street/Blue Hill River Road. This project was advertised in August 1999 and was open to traffic in October 2000.

Route 38 (Wilmington): This MassHighway project consists of widening and reconstructing Route 38 from Route 129 (Richmond Street) to Middlesex Avenue. Signalization improvements will be made at the intersections of Route 38/Clark Street, Route 38/Wilmington Plaza and Route 38/Richmond Street.

Route 1 and Associated Improvements (Foxborough): ($14 million) As a result of a directive from the Massachusetts Legislature, MassHighway will oversee a project to improve access to the new CMGI Field being built adjacent to Foxboro Stadium. Contract #1 focuses on the area from the intersection between Route 1 and North Street to the intersection of Route 1 and Pine Street in the town of Foxborough. A grade-separated interchange is to be built at the north end of the stadium on Route 1. A flyover bridge/ramp will be built on the south side of the stadium to Route 1. A new access drive will be built from North Street into the stadium. The cost of this contract is $10 million. Contract #2 deals with improvements along Route 1 between the two nearest interstate highways. A new slip ramp is to be constructed at the Route 1 / Interstate 95 interchange in Sharon. New sidewalks will be built on North Street from the access road to the Walpole town line. The shoulder along Route 1 in Foxborough and the Route 1 / Interstate 495 ramps in Plainville will be widened. Regional and local signage improvements are also part of this contract. The cost for Contract #2 is $4 million.

Route 3 North: ($385 million) The project widens Route 3 along a 21-mile stretch from Burlington to the New Hampshire border. The affected towns are Bedford, Billerica, Chelmsford, Westford, Tyngsborough, as well as Burlington. The highway is currently 2 lanes in each direction and will be expanded to 3 lanes. There will also be full right and left shoulders in each direction. All of the bridges along the corridor will be reconstructed to accommodate a potential fourth lane in each direction. The average daily traffic volumes for the New Hampshire border end of the project were 63,800 vehicles in 1999. On the Billerica portion of the project, the average daily traffic volumes were 84,000 vehicles. The MEPA approval process is complete. The design-build agreement was approved by MassHighway on August 2, 2000. There is an approximate 42-month design/build schedule. The cost and programming for this project is being carried in the Northern Middlesex Council of Governments Transportation Plan.

Transit Projects

Commuter Boat Service in the Inner Harbor: Additional MBTA commuter boat service includes new service from Lovejoy Wharf (North Station-Boston) to Courthouse Fan Pier (South Boston) and World Trade Center (South Boston). This is in addition to existing service at Charlestown Navy Yard, Long Wharf (Boston), and Logan Airport (Boston). Lovejoy Wharf and Courthouse Fan Pier were both opened in 1999.

Newburyport Commuter Rail Service: Extension of the MBTA commuter rail line from Ipswich station (Ipswich) to Newburyport, a total length of 9.6 miles. There is an intermediate stop with a new station and associated parking at Rowley. The service opened in October 1998. The additional parking at Rowley and Newburyport stations is included in the 15,931 New Parking Spaces. The service includes 13 inbound and 13 outbound trips during the week and 6 inbound and 6 outbound trips on the weekend.

Old Colony Commuter Rail (two lines): This MBTA commuter rail service includes the restoration of two of the Old Colony lines. Service runs from South Station to Middleborough/Lakeville with six intermediate stops and service from South Station to Kingston and Cordage/Plymouth with six intermediate stops. Service on the two lines began in September 1997. The additional parking at the stations is included in the 15,931 New Parking Spaces. This project does not include the proposed Greenbush branch of the Old Colony commuter rail line.

Additional Park and Ride Spaces: Included in the recommended plan is the addition of at least 1,050 new surface parking spaces. At an average cost of $5,000 per space, this is a total cost of approximately $5.2 million. Additional proposed spaces are located at the following commuter rail sites within the Boston Region MPO: Hamilton, West Gloucester, North Wilmington, Walpole and Sharon. An additional 1,685 spaces outside of the Boston Region MPO were included in the travel demand model analysis. Locations included Mansfield, Middleborough, Halifax and Lowell. These figures do not include parking associated with the Worcester or Greenbush Commuter Rail extensions. The 2,100 Park and Ride spaces being built by the Massachusetts Turnpike Authority at Interchanges 9-16 on the Massachusetts Turnpike are also included.

North Station Improvements: This MBTA project includes the relocation of the above ground portion of the Green Line to Lechmere to underground. The new rapid transit station will include a super platform with easy transfers between the Green and Orange lines.

Blue Line Modernization: The modernization program to allow for six-car operation is underway. Modernization of stations from Wood Island to Wonderland is complete. Aquarium station will be renovated in conjunction with the Central Artery work.

Worcester Commuter Rail, full service: This MBTA service will include intermediate stops in Grafton, Westborough, Southborough and Ashland. Each stop will include a new commuter rail station with associated parking. This service will replace the interim service provided between Framingham and Worcester. Full service is anticipated in the year 2001.

Silver Line – Transitway, Phase 1: This MBTA transitway will provide service via tunnel from South Station (Boston) to the World Trade Center (in the vicinity of Viaduct Street) with an intermediate station stop at Courthouse Station (in the vicinity of Northern Avenue and Farnsworth). Construction on this project is underway and Phase 1 service is scheduled to begin in 2002. This does not include Phase 2 full build. Phase 2 connects South Station to Boylston Street Station (Boston). It also includes a surface route from the D Street portal to City Point (South Boston).

Silver Line – Washington Street, Phase 2: ($54,000,000) The MBTA's Silver Line is to initially run along Washington Street from Dudley Square in Roxbury to Downtown Crossing in the city of Boston. The vehicles used on the route are 60-foot articulated compressed natural gas buses and their low-floor design makes them handicapped accessible. The buses operate in mixed traffic from Dudley Square to Melnea Cass Boulevard where they then enter a reserved lane. At the Massachusetts Turnpike, the reserved lane ends and the vehicles enter mixed traffic again. Proposed stations for the Silver Line include Dudley Square, Melnea Cass Boulevard, Lenox Street, Newton Street, Cathedral, East Berkeley Street. Additionally, the vehicle will make stops at Herald Square, New England Medical Center, Chinatown, and Downtown Crossing. This project is a Central Artery/Tunnel commitment. It is scheduled to be completed before 2002.

Mattapan Refurbishment: This MBTA project is the refurbishment of the existing PPC (Presidential Conference Committee) cars currently running on the Mattapan High-Speed line (Boston-Mattapan-Milton). There are no scheduled run time or frequency improvements associated with this project.

Amtrak Northeast Corridor Electrification: This Federal Railroad Administration/Amtrak project involves the electrification of the Northeast Corridor rail line from Boston to New Haven, CT, the purchase of high-speed train sets and expansion of Boston to New York passenger train service. Service using the electrified track began in 2000. Acela high-speed service began in December 2000.

Airport Intermodal Transit Connector: ($35 million) This project would provide a new transit service in Boston from South Station Intermodal Center to the Logan Airport terminals. There would be approximately eight vehicles, which would be similar to those used in the Silver Line-Transitway Section A, except that these vehicles have more luggage storage space. The service would use the MBTA South Boston Piers Transitway tunnel from South Station to South Boston and then the Ted Williams Tunnel to the five Logan Airport terminals. The capital portion of this service would be sponsored by Massport. This service would provide for enhanced connection between the Red Line and Logan Airport. There would continue to be AITC bus service between the Blue Line Airport Station and the Logan airport terminals. This project must be completed by June 2004 as part of the administrative consent order between EOTC and EOEA.

Industriplex Intermodal Center (Woburn): This is a joint agency (MHD, Massport, MBTA) project. The Industriplex in Woburn provides an intermodal facility for the northern suburbs that combines MBTA commuter rail, Massport's Logan Express shuttles, a 2,400 space parking lot, and a station on Amtrak's future service to Portland, Maine. Ground was broken on the Industriplex in 2000. MassHighway has completed a new interchange with Interstate 93 that improves access to the facility. In addition to its intermodal component, Industriplex provides improved access to both I-93 and Route 128, is adjacent to growing employment centers and increases parking capacity. The parking increase partially addresses SIP commitment of new park and ride spaces.

Route 128 Amtrak Station: This project jointly constructed by Amtrak and the MBTA will consist of a new station for the Northeast Corridor Amtrak service and the MBTA Attleboro service. At full-build, the station will have an associated parking garage with 2,750 parking spaces (550 reserved for Amtrak). Electrified trains (Amtrak) began serving the station in 2000. Full build is not expected until 2005 with the completion of an access road to Route 128.

Illustrative Projects

North/South Rail Link: An underground tunnel connection between North Station and South Station in downtown Boston. It would run parallel to the new depressed Central Artery. There would be one interim station in the vicinity of Aquarium Station. The Rail Link would allow MBTA commuter rail trains and Amtrak intercity trains to travel from one side of Boston to the other without the need for through passengers to transfer trains. Trains operating in the tunnel would use dual mode locomotives. The project would free up track space at North and South stations, as fewer trains would need to be turned around at the terminals. Other benefits of the project include the facilitation of suburb to suburb commutes and improved distribution of commuter rail travelers in the downtown area.

Light Rail on Washington Street (Boston): Convert bus rapid transit Silver Line service to light rail from Dudley Square in Roxbury to downtown Boston. The number of intermediate stations would be reduced to five—Melnea Cass Boulevard, Massachusetts Avenue, Newton Street, Cathedral, and Berkeley Street. The exiting Tremont Street subway tunnel would be refurbished and the portal would be rebuilt in the vicinity of Tremont and Oak Streets. Light rail vehicles along Washington Street would merge with Green Line service at Boylston and would turn at Park Street or Government Center.

Urban Ring, Phase 2 (Boston, Brookline, Cambridge, Somerville, Medford, Everett and Chelsea): Upgrade of Urban Ring Phase 1 with the introduction of Bus Rapid Transit (BRT)

routes throughout the corridor and new or improved connections with every commuter rail and radial transit line crossing the corridor. The BRT routes will feature high frequency service, high capacity vehicles, and utilize a combination of reserved right-of-way, bus lanes, and ITS features to reduce trip times and improve schedule adherence. Reserved right-of-way segments in Phase 2 include: East Boston to Chelsea along abandoned CSX rail right-of-way; within Chelsea adjacent to MBTA commuter rail line; Union Square in Somerville to Lechmere Station in Cambridge; Charlestown to Cambridge adjacent to Gilmore Bridge; Cambridge to Boston via portions of existing CS freight right-of-way; Longwood Medical Area and Roxbury via Ruggles Street and Melnea Cass Boulevard; and to the South Boston Waterfront using the Haul Road or I-93 HOV lanes. New commuter rail stations would be located at Sullivan Square on the Haverhill and Newburyport/Rockport Lines; Gilman Square in Somerville on the Lowell Line; and Union Square in Somerville on the Fitchburg Line. Existing commuter rail stations would be expanded or improved at downtown Chelsea on the Newburyport/Rockport Line; Yawkey Station in Boston on the Framingham Line; Ruggles Station in Boston serving multiple lines; Uphams Corner on the Fairmount Branch; and JFK/Umass on the Old Colony Line. The project will improve transit mobility and accessibility in the fast growing crosstown corridor, link low income and minority neighborhoods to employment and education centers; and reduce central subway congestion.

Urban Ring, Phase 3 (Inner Core): Phase 3 converts the most heavily used portions of the corridor to rail. Two alternatives will be explored. One alternative has all rail service located in a tunnel that would run from Dudley Square in Boston to Assembly Square in Somerville. Intermediate stations would include Ruggles, the Longwood Medical Area, Kenmore, Kendall Square, Lechmere and Sullivan station in addition to others. Either light rail vehicles comparable to the Green Line or rapid transit vehicles comparable to the Orange Line would be used in the tunnel. The other alternative employs tunnels only on the Dudley Square to Cambridgeport and Kendall Square to Lechmere segments of the corridor. The remainder of the Dudley-Assembly corridor would be at grade. The at grade segments result in the use of light rail vehicles for this alternative. Existing bus rapid transit routes remain primarily the same as under Phase 2, with some minor additions and deletions.

Capital Investments Not Affecting the Travel Model

Green Line Vehicles-Type 8: ($122 million) The MBTA is in the process of receiving new Green Line vehicles from the manufacturer. The vehicles feature a low-floor design that allows mobility-impaired riders to access them at any of the Green Line stations that have been designated as key stations. The Type 8 vehicles also feature interior message displays, electronic exterior route indicators, and recorded station announcements. The MBTA will purchase 100 new Green Line vehicles.

Blue Line Vehicles: ($200 million) The MBTA will purchase new six-car trainsets for the Blue Line. These vehicles can be used on the Blue Line once the reconstruction of stations has been completed. The Blue Line is the only of the three subway lines to operate only four-car trainsets during peak periods. Reconstruction of the existing stations involves the lengthening of platforms so that the longer trains can be accommodated. Once the platforms have been lengthened and the new trainsets have been purchased, the current Blue Line vehicles may be used to supplement existing vehicles on the Orange Line.

Low Emission Buses: ($126 million) The MBTA is committed to the purchase of 314 compressed natural gas (CNG) buses for use systemwide. The purchase of the new vehicles is required by 2004 in the consent order agreed to between EOTC and EOEA in 2000 relating the fulfillment of Central Artery project mitigation commitments.

Ashmont Stations Modernization: ($83 million) The MBTA will reconstruct four stations on the Ashmont branch of the Red Line. The four stations included in the project are Savin Hill, Field's Corner, Shawmut, and Ashmont--all located within the Boston neighborhood of Dorchester. In addition to the station work, some older bridges along the Ashmont branch will be rehabilitated.

Charles Street Station Modernization: ($27 million) This project involves the reconstruction of the Charles Street station on the Red Line. Goals of the project are to make the station accessible and to improve its relationship to the surrounding Charles Circle/Cambridge Street area.

Bus Maintenance Facilities: ($80 million) The MBTA's purchase of 314 new CNG buses marks the first time this type of vehicle will be used in the system. In order to service these alternative fuel vehicles, the MBTA will build new CNG maintenance facilities.

Automatic Fare Collection: ($120 million) This project involves complete replacement of the MBTA's current fare collection equipment on all subway, trolley, trackless trolley and bus vehicles. The new automatic fare collection (AFC) equipment will provide several benefits to the MBTA and its riders. In addition to the current monthly pass system, riders will be able to purchase stored value cards. This fare media acts as a debit card, allowing passengers to use any mode in the system provided that the dollar value remaining on their card is sufficient to pay the fare. Value can be added to stored value cards after they are purchased, either at fare collector booths or at automatic vending machines (AVM). Stored value cards are beneficial to less frequent riders because they can have the convenience of a pass without having to invest in an unlimited ride monthly pass. They also reduce the amount of actual cash transactions in the system. AFC turnstiles will be better able to provide accurate data on fare collection and revenue for the MBTA. Since AFC turnstiles have both read and write capabilities, the MBTA can use them as a paperless method of providing free transfers between buses. Another fare policy that can be implemented with AFC is the distance-based fare.

Green Line Accessibility: ($124 million) This project involves the completion of the Green Line's key station program. The key station program will put the Green Line in compliance with the Americans with Disabilities Act (ADA). Copley, Arlington, and Government Center stations in the central subway will be made accessible. In addition, several key stations along the Green Line's surface routes will be made accessible through the construction of elevated platforms.

AMTRAK Service to Portland, Maine: In 2001, AMTRAK will reintroduce service between Boston and Portland, Maine. The new service will use North Station as its Boston terminus. Other stops include Haverhill, Massachusetts; Exeter, Dover and Durham, New Hampshire; and Old Orchard Beach, Wells and Saco, Maine. Travel time between Boston and Portland will be approximately two and half hours.

Project descriptions for the 2025 Build Projects in the recommended plan are included in Chapter 10 – The Recommended Plan.

APPENDIX G

SUPPLEMENTAL INFORMATION FOR THE AIR QUALITY CONFORMITY DETERMINATION

Appendix G provides information used in determining the conformity determination for the Update of the Boston Region Transportation Plan.

Table G-1 shows the inputs that were used in the MOBILE5A-H emission model which calculates emission factors for the pollutants that must be analyzed – volatile organic compounds (VOC), nitrogen oxides (NOx), and carbon monoxide (CO).

Table G-2 provides the actual emission factors that were used to calculate emissions associated with the Transportation Plan Update.

Table G-3 is a status report of the Transportation Control Measures (TCMs) required in the Boston MPO area that are included in the State Implementation Plan (SIP). A requirement of the conformity determination is to ensure that all TCMs be implemented in a timely fashion. TCMs have been required in the Boston MPO area in SIP submissions in 1979, 1982, and as mitigation to the Central Artery.

Table G-4 lists categorically exempt projects – projects which are eligible for federal funding that have no impact on regional emission.

Table G-5 presents a summary of off-model emissions from the MBTA buses, commuter rail train emissions, park and ride, and commuter boat emissions.

Table G-1
Mobile 5 A-H Inputs – Year 1995 Conditions

	VOCs	Winter CO	NOx
Tampering rates	Mobile 5A-H defaults	Mobile 5A-H defaults	Mobile 5A-H defaults
VMT mix	VMFLAG 1, Mobile5A-H defaults	VMFLAG 1, Mobile5A-H defaults	VMFLAG 1, Mobile5A-H defaults
Annual Mileage Accumulation and/or Registration Distribution by Age	MYMRFG 3 Default accumulation rates/Massachusetts specific registration distribution	MYMRFG 3 Default accumulation rates/Massachusetts specific registration distribution	MYMRFG 3 Default accumulation rates/Massachusetts specific registration distribution
Modified Basic Exhaust Emission Rates (BERs)	Mobile 5A-H defaults	Mobile 5A-H defaults	Mobile 5A-H defaults
Inspection and Maintenance	IMFLAG 2 - Single program	IMFLAG 2 - Single program	IMFLAG 2 - Single program
program start year	1983	1983	1983
stringency level	12%	12%	12%
first model year subject to program	1980	1980	1980
last model year subject to program	1994	1994	1994
waiver rate pre-1981	1%	1%	1%
waiver rate 1981-present	1%	1%	1%
compliance rate	80%	80%	80%
program type	Computerized inspection and repair	Computerized inspection and repair	Computerized inspection and repair
inspection frequency	annual	annual	annual
vehicles subject to inspection	LDGV,LDGV1,LDGV2	LDGV,LDGV1,LDGV2	LDGV,LDGV1,LDGV2
test type	idle	idle	idle
alternative credits	no alternative credits	no alternative credits	no alternative credits
transient test	not modeled	not modeled	not modeled
purge system check	not modeled	not modeled	not modeled
presure check	not modeled	not modeled	not modeled
Exhaust Emission Correction Factors	no corrections	no corrections	no corrections
Anti-tampering program	ATPFLAG 1 - not modeled	ATPFLAG 1 - not modeled	ATPFLAG 1 - not modeled
Refueling Emission Factors	flag switch "2"-program modeled	flag switch "2"-program modeled	flag switch "2"
stage II start year	1991	1991	1991
phase in period	3 years	3 years	3 years
"system efficiency for light-duty vehicles"	84%	84%	84%
"system efficiency for heavy-duty vehicles"	84%	84%	84%
Local Area Parameter Record	flag switch "1"	flag switch "1"	flag switch "1"
minimum daily temp (˚F)	68˚ F	35˚ F	68˚ F
maximum daily temp (˚F)	94˚ F	45˚ F	94˚ F
period 1 Reid Vapor Pressure	11.5 psi	13.5 psi	11.5 psi
period 2 Reid Vapor Pressure	9.0 psi	13.5 psi	9.0 psi
period 2 start year	1989	1989	1989
oxygenated fuels flag	flag switch "1"- not modeled	flag switch "1"- not modeled	flag switch "1"- not modeled
diesel sales fraction	flag switch "1"- not modeled	flag switch "1"- not modeled	flag switch "1"- not modeled
reformulated fuel flag	flag switch "2"-modeled	flag switch "2"-modeled	flag switch "2"-modeled
Temperature Values	flag switch "1"- daily average	flag switch "1"- daily average	flag switch "1"- daily average
Composition of Hydrocarbons	flag switch "3" - VOC	flag switch "3" (No hydrocarbons calculated for CO)	flag switch "3" (No hydrocarbons calculated for NOx)
Scenario Section			
region	flag switch "4"- CA LEV Program	flag switch "4"- CA LEV Program	flag switch "4"- CA LEV Program
calendar year of evaluation	run specific	run specific	run specific
average speed	scenario specific	scenario specific	scenario specific
ambient temp (˚F)	85.4˚F	40°F	85.4˚F
operating mode fractions	20.6/27.3/20.6	20.6/27.3/20.6	20.6/27.3/20.6
month of evaluation	flag switch "7"-July	flag switch "1"-January	flag switch "7"-July
LEV Program phase-in year	1994	1994	1994
I/M Program for LEV Program	flag switch "1"-standard I/M	flag switch "1"-standard I/M	flag switch "1"-standard I/M

Table G-1
Mobile 5 A-H Inputs (cont.) – Years 2003 through 2020

	VOCs	Winter CO	NOx
Tampering rates	Mobile 5A-H defaults	Mobile 5A-H defaults	Mobile 5A-H defaults
VMT mix	VMFLAG 1, Mobile5A-H defaults	VMFLAG 1, Mobile5A-H defaults	VMFLAG 1, Mobile5A-H defaults
Annual Mileage Accumulation and/or Registration Distribution by Age	MYMRFG 3 Default accumulation rates/Massachusetts specific registration distribution	MYMRFG 3 Default accumulation rates/Massachusetts specific registration distribution	MYMRFG 3 Default accumulation rates/Massachusetts specific registration distribution
Modified Basic Exhaust Emission Rates (BERs)	Mobile 5A-H defaults	Mobile 5A-H defaults	Mobile 5A-H defaults
Inspection and Maintenance Enhanced Program	IMFLAG 22, (Enhanced I&M and Technician training)	IMFLAG 22, (Enhanced I&M and Technician training)	IMFLAG 22, (Enhanced I&M and Technician training)
program start year	1999	1999	1999
stringency level	20%	20%	20%
first model year subject to program	1984	1984	1984
last model year subject to program	analysis year - 2	analysis year - 2	analysis year - 2
waiver rate pre-1981	0%	0%	0%
waiver rate 1981-present	1%	1%	1%
compliance rate	98%	98%	98%
program type	inspection only	inspection only	inspection only
inspection frequency	biennial	biennial	biennial
vehicles subject to inspection	LDGV,LDGV1,LDGV2,HDGV	LDGV,LDGV1,LDGV2,HDGV	LDGV,LDGV1,LDGV2,HDGV
test type	transient test	transient test	transient test
alternative credits	alternate I/M files specified	alternate I/M files specified	alternate I/M files specified
cutpoint for hydrocarbon	25	25	25
cutpoint for carbon monoxide	50	50	50
cutpoint for nitrogen oxides	2	2	2
Anti-tampering program	ATPFLAG 8 - program modeled	ATPFLAG 8 - program modeled	ATPFLAG 8 - program modeled
program start year	1999	1999	1999
first model year subject to program	1984	1984	1984
last model year subject to program	analysis year - 2	analysis year - 2	analysis year - 2
vehicles subject to program	LDGV,LDGV1,LDGV2,HDGV	LDGV,LDGV1,LDGV2,HDGV	LDGV,LDGV1,LDGV2,HDGV
program type	inspection only	inspection only	inspection only
inspection frequency	biennial	biennial	biennial
compliance rate	98%	98%	98%
inspections performed:			
air system	tested	tested	tested
catalyst	tested	tested	tested
fuel inlet restrictor	not tested	not tested	not tested
tailpipe lead deposit test	not tested	not tested	not tested
EGR system	tested	tested	tested
evaporative system	tested	tested	tested
PCV	not tested	not tested	not tested
gas cap	tested	tested	tested
Pressure data			
program start year	1999	1999	1999
first model year subject to program	1984	1984	1984
last model year subject to program	analysis year - 2	analysis year - 2	analysis year - 2
vehicles subject to inspection	LDGV,LDGV1,LDGV2,HDGV	LDGV,LDGV1,LDGV2,HDGV	LDGV,LDGV1,LDGV2,HDGV
program type	inspection only	inspection only	inspection only
inspection frequency	biennial	biennial	biennial
compliance rate	98%	98%	98%

TABLE G-1
Mobile 5 A-H Inputs (cont.) – Years 2003 through Conditions

	VOCs	Winter CO	NOx
Purge data			
program start year	1999	1999	1999
first model year subject to program	1984	1984	1984
last model year subject to program	analysis year - 2	analysis year - 2	analysis year - 2
vehicles subject to inspection	LDGV,LDGV1,LDGV2,HDGV	LDGV,LDGV1,LDGV2,HDGV	LDGV,LDGV1,LDGV2,HDGV
program type	inspection only	inspection only	inspection only
inspection frequency	biennial	biennial	biennial
compliance rate	98%	98%	98%
Refueling Emission Factors	flag switch "2"-program modeled	flag switch "2"-program modeled	flag switch "2"
stage II start year	1991	1991	1991
phase in period	3 years	3 years	3 years
"system efficiency for light-duty vehicles"	84%	84%	84%
"system efficiency for heavy-duty vehicles"	84%	84%	84%
Local Area Parameter Record	flag switch "1"	flag switch "1"	flag switch "1"
minimum daily temp (˚F)	68˚ F	35˚ F	68˚ F
maximum daily temp (˚F)	94˚ F	45˚ F	94˚ F
period 1 Reid Vapor Pressure	11.5 psi	13.5 psi	11.5 psi
period 2 Reid Vapor Pressure	9.0 psi	13.5 psi	9.0 psi
period 2 start year	1989	1989	1989
oxygenated fuels flag	flag switch "1"- not modeled	flag switch "1"- not modeled	flag switch "1"- not modeled
diesel sales fraction	flag switch "1"- not modeled	flag switch "1"- not modeled	flag switch "1"- not modeled
reformulated fuel flag	flag switch "2"-modeled	flag switch "2"-modeled	flag switch "2"-modeled
Temperature Values	flag switch "1"- daily average	flag switch "1"- daily average	flag switch "1"- daily average
Composition of Hydrocarbons	flag switch "3" - VOC	flag switch "3" (No hydrocarbons calculated for CO)	flag switch "3" (No hydrocarbons calculated for NC
Scenario Section			
region	flag switch "4"- CA LEV Program	flag switch "4"- CA LEV Program	flag switch "4"- CA LEV Program
calendar year of evaluation	run specific	run specific	run specific
average speed	scenario specific	scenario specific	scenario specific
ambient temp (˚F)	85.4˚F	40°F	85.4˚F
operating mode fractions	20.6/27.3/20.6	20.6/27.3/20.6	20.6/27.3/20.6
month of evaluation	flag switch "7"-July	flag switch "1"-January	flag switch "7"-July
LEV Program phase-in year	1994	1994	1994
I/M Program for LEV Program	flag switch "1"-standard I/M	flag switch "1"-standard I/M	flag switch "1"-standard I/M

Table G-2
VOC Emission Factors – MOBILE 5A-H
(grams/mile) 9/4/00

Speed (mph)	1995	1997	2003	2010	2020	2020 used for 2025
idle	19.178	17.06	9.203	7.75	7.47	7.47
2.5	17.015	15.879	6.259	4.901	4.662	4.662
3	13.464	12.517	5.162	4.047	3.856	3.856
4	9.544	8.831	3.901	3.071	2.935	2.935
5	7.461	6.888	3.197	2.53	2.423	2.423
6	6.18	5.701	2.747	2.183	2.095	2.095
7	5.316	4.903	2.432	1.941	1.865	1.865
8	4.818	4.453	2.235	1.784	1.715	1.715
9	4.432	4.104	2.079	1.659	1.596	1.596
10	4.112	3.814	1.949	1.556	1.497	1.497
11	3.841	3.569	1.837	1.468	1.412	1.412
12	3.607	3.357	1.739	1.392	1.339	1.339
13	3.402	3.17	1.652	1.325	1.275	1.275
14	3.22	3.004	1.575	1.265	1.218	1.218
15	3.056	2.855	1.505	1.212	1.167	1.167
16	2.907	2.719	1.44	1.164	1.12	1.12
17	2.77	2.594	1.381	1.12	1.078	1.078
18	2.644	2.478	1.327	1.08	1.04	1.04
19	2.527	2.371	1.276	1.043	1.005	1.005
20	2.426	2.276	1.225	1.004	0.967	0.967
21	2.347	2.199	1.183	0.968	0.931	0.931
22	2.273	2.128	1.143	0.934	0.899	0.899
23	2.206	2.063	1.107	0.903	0.869	0.869
24	2.143	2.002	1.073	0.875	0.841	0.841
25	2.085	1.946	1.042	0.849	0.816	0.816
26	2.03	1.894	1.013	0.824	0.792	0.792
27	1.98	1.845	0.986	0.801	0.77	0.77
28	1.932	1.799	0.961	0.78	0.749	0.749
29	1.887	1.756	0.937	0.76	0.73	0.73
30	1.845	1.716	0.914	0.741	0.711	0.711
31	1.805	1.678	0.893	0.724	0.694	0.694
32	1.768	1.642	0.873	0.707	0.678	0.678
33	1.732	1.607	0.854	0.692	0.663	0.663
34	1.698	1.575	0.836	0.677	0.649	0.649
35	1.666	1.544	0.819	0.663	0.636	0.636
36	1.636	1.515	0.803	0.65	0.623	0.623
37	1.607	1.487	0.787	0.638	0.611	0.611
38	1.58	1.461	0.773	0.626	0.599	0.599
39	1.553	1.435	0.759	0.615	0.589	0.589
40	1.528	1.411	0.745	0.604	0.578	0.578
41	1.504	1.388	0.732	0.594	0.569	0.569
42	1.481	1.366	0.72	0.584	0.559	0.559
43	1.459	1.345	0.708	0.575	0.551	0.551
44	1.438	1.324	0.697	0.566	0.542	0.542
45	1.418	1.305	0.686	0.558	0.534	0.534
46	1.399	1.286	0.676	0.55	0.527	0.527
47	1.38	1.268	0.666	0.542	0.519	0.519
48	1.362	1.25	0.656	0.535	0.512	0.512
49	1.355	1.243	0.654	0.533	0.51	0.51
50	1.349	1.237	0.651	0.531	0.508	0.508
51	1.343	1.231	0.649	0.529	0.506	0.506
52	1.337	1.226	0.647	0.527	0.504	0.504
53	1.332	1.221	0.645	0.525	0.502	0.502
54	1.327	1.216	0.643	0.523	0.501	0.501
55	1.322	1.211	0.642	0.522	0.499	0.499
56	1.349	1.232	0.651	0.529	0.506	0.506
57	1.377	1.253	0.661	0.536	0.513	0.513
58	1.405	1.275	0.671	0.544	0.519	0.519
59	1.434	1.296	0.681	0.551	0.526	0.526
60	1.463	1.318	0.691	0.559	0.533	0.533
61	1.491	1.341	0.702	0.567	0.541	0.541
62	1.521	1.363	0.712	0.575	0.548	0.548
63	1.55	1.386	0.722	0.582	0.555	0.555
64	1.58	1.408	0.733	0.591	0.563	0.563
65	1.61	1.432	0.744	0.599	0.571	0.571

Table G-2
NOx Emission Factors – MOBILE 5A-H
(grams/mile) 9/4/00

Speed (mph)	1995	1997	2003	2010	2020	2020 used for 2025
idle	9.73	9.17	6.483	5.77	5.63	5.63
2.5	3.891	3.667	2.593	2.308	2.251	2.251
3	3.72	3.503	2.482	2.209	2.157	2.157
4	3.486	3.279	2.327	2.073	2.025	2.025
5	3.325	3.126	2.221	1.979	1.934	1.934
6	3.203	3.011	2.14	1.906	1.863	1.863
7	3.105	2.919	2.074	1.848	1.806	1.806
8	3.023	2.843	2.018	1.798	1.758	1.758
9	2.953	2.777	1.971	1.755	1.716	1.716
10	2.892	2.72	1.929	1.718	1.679	1.679
11	2.838	2.67	1.892	1.684	1.646	1.646
12	2.79	2.626	1.859	1.654	1.617	1.617
13	2.747	2.586	1.829	1.628	1.59	1.59
14	2.708	2.55	1.803	1.604	1.566	1.566
15	2.673	2.517	1.778	1.582	1.545	1.545
16	2.642	2.488	1.756	1.562	1.525	1.525
17	2.614	2.462	1.737	1.544	1.508	1.508
18	2.588	2.438	1.719	1.528	1.491	1.491
19	2.565	2.416	1.702	1.513	1.477	1.477
20	2.549	2.401	1.69	1.502	1.466	1.466
21	2.545	2.396	1.684	1.496	1.46	1.46
22	2.541	2.391	1.679	1.491	1.454	1.454
23	2.538	2.387	1.675	1.486	1.45	1.45
24	2.535	2.384	1.671	1.482	1.445	1.445
25	2.534	2.381	1.667	1.479	1.442	1.442
26	2.533	2.38	1.665	1.477	1.439	1.439
27	2.532	2.379	1.663	1.475	1.437	1.437
28	2.533	2.378	1.662	1.474	1.436	1.436
29	2.534	2.379	1.661	1.473	1.435	1.435
30	2.536	2.38	1.661	1.473	1.435	1.435
31	2.539	2.382	1.662	1.473	1.435	1.435
32	2.543	2.385	1.663	1.474	1.436	1.436
33	2.548	2.388	1.666	1.476	1.438	1.438
34	2.553	2.393	1.668	1.479	1.44	1.44
35	2.559	2.398	1.672	1.482	1.443	1.443
36	2.566	2.404	1.676	1.485	1.447	1.447
37	2.574	2.411	1.681	1.489	1.451	1.451
38	2.583	2.419	1.686	1.494	1.456	1.456
39	2.593	2.427	1.692	1.5	1.461	1.461
40	2.604	2.437	1.699	1.506	1.468	1.468
41	2.616	2.447	1.707	1.513	1.475	1.475
42	2.629	2.459	1.716	1.521	1.482	1.482
43	2.643	2.472	1.725	1.529	1.491	1.491
44	2.659	2.485	1.735	1.539	1.5	1.5
45	2.676	2.5	1.746	1.549	1.51	1.51
46	2.694	2.516	1.758	1.56	1.521	1.521
47	2.713	2.534	1.771	1.572	1.533	1.533
48	2.734	2.552	1.786	1.585	1.546	1.546
49	2.817	2.627	1.832	1.625	1.584	1.584
50	2.902	2.702	1.879	1.666	1.624	1.624
51	2.988	2.78	1.927	1.708	1.665	1.665
52	3.076	2.859	1.977	1.752	1.708	1.708
53	3.166	2.939	2.029	1.797	1.751	1.751
54	3.259	3.022	2.081	1.843	1.796	1.796
55	3.353	3.107	2.136	1.891	1.842	1.842
56	3.45	3.194	2.192	1.941	1.89	1.89
57	3.55	3.283	2.25	1.992	1.94	1.94
58	3.652	3.375	2.31	2.045	1.991	1.991
59	3.757	3.47	2.372	2.1	2.045	2.045
60	3.866	3.568	2.436	2.157	2.1	2.1
61	3.978	3.668	2.503	2.216	2.158	2.158
62	4.093	3.772	2.572	2.277	2.218	2.218
63	4.213	3.88	2.644	2.342	2.281	2.281
64	4.337	3.992	2.72	2.409	2.347	2.347
65	4.465	4.108	2.798	2.479	2.416	2.416

Table G-2
Winter CO Emission Factors – MOBILE 5A-H
(grams/mile) 9/4/00

Speed (mph)	1995	1997	2003	2010	2020	2020 used for 2025
idle	375.17	320.87	174.89	143.73	136.61	136.61
2.5	150.069	128.346	69.954	57.491	54.642	54.642
3	127.771	109.618	60.189	49.651	47.263	47.263
4	99.346	85.836	47.822	39.698	37.884	37.884
5	81.892	71.29	40.26	33.593	32.12	32.12
6	70.041	61.436	35.126	29.432	28.184	28.184
7	61.452	54.303	31.393	26.398	25.308	25.308
8	54.934	48.892	28.547	24.078	23.103	23.103
9	49.816	44.643	26.299	22.24	21.355	21.355
10	45.689	41.215	24.476	20.745	19.93	19.93
11	42.29	38.391	22.966	19.505	18.745	18.745
12	39.442	36.023	21.693	18.457	17.744	17.744
13	37.021	34.008	20.605	17.559	16.885	16.885
14	34.937	32.273	19.665	16.783	16.141	16.141
15	33.125	30.763	18.844	16.103	15.49	15.49
16	31.533	29.437	18.121	15.505	14.915	14.915
17	30.125	28.263	17.48	14.973	14.404	14.404
18	28.869	27.217	16.907	14.498	13.948	13.948
19	27.743	26.278	16.393	14.071	13.538	13.538
20	26.659	25.263	15.713	13.484	12.971	12.971
21	25.565	24.106	14.874	12.752	12.263	12.263
22	24.568	23.053	14.111	12.086	11.619	11.619
23	23.656	22.091	13.414	11.477	11.03	11.03
24	22.819	21.208	12.775	10.92	10.491	10.491
25	22.048	20.395	12.187	10.407	9.995	9.995
26	21.335	19.645	11.645	9.934	9.538	9.538
27	20.675	18.95	11.144	9.497	9.115	9.115
28	20.061	18.305	10.679	9.092	8.723	8.723
29	19.491	17.706	10.247	8.715	8.359	8.359
30	18.959	17.147	9.845	8.364	8.019	8.019
31	18.463	16.625	9.469	8.036	7.703	7.703
32	17.999	16.137	9.118	7.73	7.407	7.407
33	17.565	15.68	8.789	7.443	7.13	7.13
34	17.159	15.251	8.481	7.174	6.87	6.87
35	16.778	14.849	8.191	6.922	6.627	6.627
36	16.42	14.471	7.918	6.684	6.397	6.397
37	16.085	14.115	7.661	6.461	6.182	6.182
38	15.77	13.78	7.419	6.25	5.978	5.978
39	15.474	13.464	7.19	6.051	5.787	5.787
40	15.197	13.166	6.974	5.863	5.606	5.606
41	14.936	12.886	6.77	5.686	5.435	5.435
42	14.691	12.62	6.576	5.518	5.274	5.274
43	14.461	12.37	6.394	5.359	5.121	5.121
44	14.244	12.134	6.22	5.209	4.977	4.977
45	14.041	11.91	6.056	5.067	4.84	4.84
46	13.849	11.698	5.901	4.933	4.711	4.711
47	13.669	11.498	5.754	4.805	4.589	4.589
48	13.5	11.309	5.614	4.685	4.474	4.474
49	13.507	11.315	5.617	4.688	4.477	4.477
50	13.517	11.322	5.623	4.692	4.481	4.481
51	13.529	11.332	5.629	4.698	4.488	4.488
52	13.545	11.344	5.638	4.706	4.496	4.496
53	13.563	11.359	5.648	4.715	4.505	4.505
54	13.584	11.376	5.66	4.726	4.517	4.517
55	13.608	11.395	5.673	4.739	4.53	4.53
56	15.409	12.708	6.174	5.106	4.87	4.87
57	17.213	14.024	6.677	5.475	5.211	5.211
58	19.02	15.343	7.182	5.847	5.555	5.555
59	20.832	16.666	7.689	6.22	5.901	5.901
60	22.648	17.991	8.199	6.596	6.249	6.249
61	24.468	19.32	8.712	6.975	6.6	6.6
62	26.293	20.653	9.227	7.356	6.954	6.954
63	28.124	21.991	9.746	7.74	7.311	7.311
64	29.96	23.333	10.268	8.127	7.671	7.671
65	31.802	24.68	10.793	8.517	8.034	8.034

Table G-3
Status Report of the 1979, 1982 and Central Artery State Implementation Plan TCMs

Transportation Control Measures In the 1979 SIP	Plan Update	Status in 2002
MBTA Plant Improvements •Green Line improvements •Station modernization (Park, State, Washington) •Miscellaneous plant improvements	 X	 implemented and ongoing completed - other stations now being modernized (Blue Line) implemented and ongoing
MBTA Vehicle Fleet Improvements	X	implemented and ongoing
Commuter Rail Improvement Program	X	implemented and ongoing
MBTA Park 'n' Ride Program •Alewife, Quincy Adams, & Braintree •Forest Hills •Mishawam	 X X X	 complete - further expansion planned complete - further expansion planned complete – further expansion planned
Reduction and Relocation of bus stops	X	implemented and ongoing
Urban Systems (TOPICS-type) Program	X	implemented and ongoing
Off-Street Parking Freeze - City of Boston		implemented and ongoing
Off-Street Parking Freeze - City of Cambridge		implemented and ongoing
Off-Street Parking Freeze - Logan Airport		implemented and ongoing
Public Information/Promotion •Bus stop sign replacement •Information kiosks		 implemented and ongoing implemented and ongoing
Commuter Boat Service Demonstration (Hingham to Boston)	X	regular contract service ongoing
Red Line Extension from Quincy to Braintree	X	completed & opened for service in 1980
Red Line Extension from Harvard to Alewife	X	completed & opened for service in 1985
Orange Line Extension from South Cove to Forest Hills	X	completed & opened for service in 1987
Downtown Crossing Pedestrian Zone		implemented & ongoing
Boston Resident Parking Sticker Program		implemented & ongoing
Cambridge Resident Parking Sticker Program		implemented and ongoing
MDC On-Street Parking Ban		ongoing
MBTA Pass Program		implemented and ongoing
Masspool, Inc. (CARAVAN)	X	ongoing
Extension of I-93 HOV Lane to Charlestown	X	complete
MBTA Suburban Bus Program	X	ongoing
State/Local Financing Net Cost of T-Service • review of fare changes shall involve the public and consider environmental impacts		ongoing
Bicycle Racks at transit stations		ongoing
MDPW (MHD) Bikeway Program		ongoing
Variable Work Hours Program		ongoing
MBTA Idling Reduction Program		implemented and ongoing
Right-Turn on Red		implemented and ongoing
Charlestown Bus Garage		completed 1979
Bus Immersion Heater Program		discontinued, new bus purchases subject to increasingly stringent emission standards
Improved Service Delivery • priority signals, automated fare collection, scheduling and routing modifications, & passenger shelters	X	implemented and ongoing
Improved Service Evaluation		ongoing

TABLE G-3 (CONT.)
Status Report of the 1979, 1982 and Central Artery State Implementation Plan TCMs

Transportation Control Measures In the 1982 SIP	Plan Update	Status in 2002
Improved Public Transit • Downtown Private Bus Parking • Insurance Discounts for Private Bus Riders • Improved Logan Bus Service • Newton Rider Bus Service Vehicle Replacement & Modernization		 ongoing discounts for MBTA pass holders ongoing discontinued, substituted with MBTA service completed & ongoing
Area-Wide Ridesharing Programs	X	ongoing
On-Street Parking Controls • Resident Parking Sticker Programs • Boston Tow and Hold Program • Cambridge Zoning Ordinance Change		ongoing
Pedestrian Malls - Auto Restriction Zones		ongoing in Salem, discontinued in other cities; substituted with other program.
Employer-Based Ridesharing Programs • Airport Ridesharing Program		ongoing
Road Pricing to Discourage Single-Occupant Vehicles • Mass Pike, Callahan/Sumner Carpool Incentive Program		ongoing
Interstate 93 Southbound HOV Lane	X	implemented, ongoing
Traffic Flow Improvements - Urban Systems Projects	X	ongoing
Fringe Parking/Park and Ride Lots	X	ongoing
Long -Range Public Transit Improvements • Private Carrier Bus Leasing Program		ongoing
Bicycle Facilities • Long distance bike facilities • Bicycle travel on the MBTA • Bicycle Storage Facilities		 - implemented - ongoing - installed at South Acton Commuter Rail Station
Central Artery Mitigation Construction Projects	**2000 Transp. Plan**	**Status in 2002**
South Station Bus Terminal	X	Opened for operations on October 28, 1995
South Station Track #12	X	Operating, effective Dec. 20, 1995
Ipswich Commuter Rail extension to Newburyport	X	Revenue service began October 1998
Old Colony Commuter Rail Extension	X	Full weekday service implemented Plymouth and Middleborough Lines in December 1997. Greeenbush included in ACO, substitution submitted to DEP.
Framingham Commuter Rail Extension to Worcester	X	Interim service started in September, 1995
20,000 new park and ride and commuter rail station parking spaces	X	Completed – 2001
Blue Line Platform lengthening and modernization	X	Five stations have been modified for 6 car trains. Work continues on downtown stations. Consent order establishes a new deadline of 12-31-04.
Green Line Arborway Restoration	X	Infeasibility study not accepted by DEP. MBTA going forward with construction of project.
South Boston Piers Electric Bus Service	X	Petition for delay until 12/31/03 accepted by DEP.
Green Line Extension to Medford Hillside (Tufts)	X	Scheduled completion 2011
Blue Line Connection from Bowdoin Station to Red Line at Charles Station	X	Scheduled completion 2011
Silver Line (Washington Street Replacement)	X	Bus Rapid Transit with 40 foot CNG buses operating by May 1, 2002. Service with 60 foot CNG buses by December 31, 2002
Alternative Fuel Bus Purchase	X	MBTA has advertised a procurement for 428 alternative fuel vehicles, 243 of which have purchase orders.
South Boston Parking Freeze		Regulation adopted in 1993, inventory and plan in development.

Table G-3 (cont.)
Status Report of the 1979, 1982 and Central Artery State Implementation Plan TCMs

Central Artery Mitigation Study Projects	Plan Update	Status in 2002
I-93 Southbound HOV Lane to Mystic Avenue	X	Completed
I-93 HOV Lane from Mystic Avenue to Route 128		Further study required
I-93 (SE Expressway) HOV Lane from I-90 to Route 3	X	Opened November, 1995
Development of issues to be addressed in the Program for Mass Transportation	X	PMT adopted 1994
Toll Pricing feasibility to Logan Airport		in progress
Feasibility of toll booth on Route 1A		completed June, 1994
Feasibility of water shuttle between Boston and North Shore	X	completed 1991
Transit improvements study - PMT	X	PMT adopted 1994
Feasibility of rail connection between South Station and Logan Airport		final report issued July, 1994
Expansion of size and number of Logan Express service parking and transit facilities	X	completed June, 1994
Expanding high occupancy vehicle lanes and services within Logan Airport	X	completed June, 1994
Connecting circumferential transit facilities and radial transit services	X	interim cross-town service started September, 1994; Urban Ring Study underway
Upgrade rail service to NY; Worcester & Springfield, MA.; Hartford, CT.; and Portland, ME.	X	in progress
Examine indexing of transit fares	X	ongoing, indexing issue discussed as part of annual fare review.
Feasibility of HOV Lanes on I-90 between I-93 and I-95	X	completed 1994
Urban Ring	X	ENF and MIS submitted July 27, 2001. MEPA certificate issued October 2001.

An Administrative Consent Order (ACO) was signed by EOTC and the Executive Office of Environmental Affairs (EOEA) on September 1, 2000. The ACO reconciles and adjusts dates of completion for all projects required as mitigation for the Central Artery that have not been completed to date. This conformity determination includes all projects that are part of the ACC

Table G-4
Categorically Exempt Projects

Certain transportation projects eligible for federal funding have no impact on regional emissions. These are 'neutral' projects that, because of their nature, will not affect the outcome of regional emissions analyses and add no substance to those analyses. As a result, DOT and EPA have agreed that such projects may be excluded from the regional emissions analyses required in order to determine conformity of TIPs and Plans. Projects eligible for this treatment are as follows:

Safety

Railroad/highway crossing
Pavement marking demonstration
Hazard elimination program
Safer off-system roads (non-federal-aid system)
Emergency relief (23 U.S.C. 125)
Also specific projects for:

- intersection channelization projects
- shoulder improvements
- truck size and weight inspection stations
- safety improvement program
- intersection signalization projects
- railroad/highway crossing warning devices
- changes in vertical and horizontal alignment
- increasing sight distance
- guardrails, median barriers, crash cushions
- pavement resurfacing and/or rehabilitation
  widening narrow pavements or reconstructing bridges (less than one travel lane)
- noise attenuation
- fencing
- skid treatments
- safety roadside rest areas
- other traffic control devices
- truck climbing lanes
- lighting improvements
- adding medians

Mass Transit

- Purchase of office, shop, and operating equipment for existing facilities
- Purchase of operating equipment for vehicles (e.g. radios, fareboxes, lifts, etc.)
- Construction or renovation of power, signal, and communications systems
- Operating assistance
- Rehabilitation of transit vehicles
- Reconstruction or renovation of transit buildings and structures (e.g. rail or bus buildings, storage and maintenance facilities, stations, terminals, and ancillary structures)
- Construction of small passenger shelters and information kiosks
- Rehabilitation or reconstruction of track structures, track, and trackbed in existing rights-of-way
- Noise attenuation
- Purchase of support vehicles (e.g. autos, vans)
- Purchase of new buses and rail cars to replace existing vehicles or for minor expansion of the fleet to provide new service
- Construction of new bus and rail storage and maintenance facilities which meet the conditions for categorical exclusion specified in 23 CFR 771

Table G-4 (cont.)
Categorically Exempt Projects

Air Quality

- Continuation of ride-sharing and van-pooling promotion activities at current levels
- Bicycle projects
- Pedestrian facilities

Other

- Engineering to define elements of proposed action or alternatives to assess social, economic, and environmental effects
- Advance land acquisitions as prescribed in 23 CFR 771
- Acquisition of scenic easements
- Plantings, landscaping, etc.
- Sign Removal

Table G-5
Summary of Off-Model Emissions
For MBTA Buses, Commuter Rail, Commuter Boat Within and Surrounding the Boston MPO Area
(All Emissions in Tons/Summer Day)

	2003 Action	2010 Action	2020 Action	2025 Action
VOC Emissions (tons)				
MBTA Bus	0.196	0.210	0.210	0.210
Comm Rail	0.330	0.322	0.279	0.261
Comm Boat	0.431	0.431	0.431	0.431
Pike Park & Ride	-0.041	-0.033	-0.032	-0.032
Total VOC	0.916	0.930	0.889	0.871
NOx Emissions (tons)				
MBTA Bus	1.043	0.966	0.966	0.966
Comm Rail	7.195	5.759	4.957	4.618
Comm Boat	0.815	0.815	0.815	0.815
Pike Park & Ride	-0.074	-0.066	-0.064	-0.064
Total NOx	8.978	7.474	6.674	6.335

Table G-5 provides supplemental emissions information on activities that occur across MPO boundaries in Eastern Massachusetts. CTPS has the capability of calculating these emissions and has provided this information for the Boston MPO Region. These emissions have not been included in the Plan analyses for any other MPOs in Eastern Massachusetts. Emissions have been provided for the commuter rail, commuter boat and the MBTA bus activities. The emissions from Table G-5 were combined with the emissions from the ten MPOs in Eastern Massachusetts.

APPENDIX H

LAND USE SCENARIO DEVELOPMENT

As discussed in Chapter 2, three land use scenarios were developed for use in modeling alternative transportation networks for the year 2025. The following are the assumptions that were used in their development.

BASIC FORECASTS

Basic forecasts of population, households, and employment were derived from a two-stage process. In the first stage, historical trends were projected into the future, and in the second, the results of the first stage were examined and adjusted, as necessary. As a part of that first stage, regional control totals were first established by examining forecasts for the country, the New England region and the state, and then projecting the Boston region's share of that growth. With these control totals in place, forecasts were then made at a community level.

In the first stage of the forecasting process for population, after a regional control total had been established, the most recent 20-year trends in births, deaths, and migration in each community were extended to 2025. Then, the most recent 20-year trend in average household size in each community was also extended to 2025. These two measures in combination yielded forecasts of households. Forecast population living in group quarters was also accounted for in this process. The sums of population and households across all communities were compared to the regional control totals, and adjustments were made, as necessary, to ensure that the sums equaled the control totals.

In the first stage of the forecasting process for employment, after regional control totals had been established for total employment and employment by each of nine categories (service, government, construction, etc.), forecasts were prepared for each community. This was accomplished by examining, within each community, past trends in employment by category and then extending them out to the future. Special procedures were utilized to prevent the historically declining manufacturing category from

extending out to an unreasonably low future level, and similar procedures were used to prevent the historically fast-growing service category from extending out to an unreasonably high future level. Once the categorical and total forecasts were obtained for each community, their sums were compared to the regional control totals. Adjustments were then made where necessary to ensure that the sums across all communities equaled the control totals.

In the second stage of the forecasting process for population, households and employment, MAPC sent the forecasts to all 101 communities in the Boston region for their review and comment. Based on comments received, population or employment was changed for a community, and the regional control totals adjusted. The Basic Forecast Map in Figure H-1 shows the forecast density for each TAZ under this scenario. Forecasts for the 63 non-MPO communities in the modeled region were also based on extended trends, in consultation with the appropriate Regional Planning Agency. Prior to their use in travel forecasting, community-level forecasts were disaggregated to TAZs using historical community-to-TAZ distributions.

In contrast to the land use scenarios described below, these forecasts of population, households, and employment, based largely on extending historical trends into the future, were done with little or no accounting of the influence that transportation, water, and sewer infrastructure constraints might have. Such accounting might have occurred as community officials commented on the results of the first-stage forecast results. Most of the commentary, however, advocated for higher forecasts than the first stage of the process had produced.

Water and Sewer Constraints

Under this scenario, development continues in a community at its Trends Extended pace until it reaches the capacity of existing (or currently planned) infrastructure. Remaining population and employment growth is allocated to communities that have the water supply and wastewater infrastructure to accommodate it.

Each community's water supply capacity is based on their Water Management Act withdrawal permit. Current water use (average day) is based on the average annual water demand for the 5 most recent years available (1994-1998). Demand minus supply determines how much water is available in each community for future growth.

The 2025 water demand is estimated for the Trends Extended forecast growth in population and employment, based on a water use factor of 75 gallons per day per person, and three categories of water use factors for employment (basic, retail, services). Where towns do not have sufficient supply to meet 2025 demand, some of the population and employment growth is reallocated out of deficit towns, bringing each town down to the level that its available water will support. Total population and employment for the region remains the same as under Basic Forecast. The reallocated "deficit" town growth is reallocated to those communities that have a significant surplus and adequate sewer capacity. "Surplus" towns are put into 3 categories:

1. "Water limited" – towns that can accommodate 2025 growth, but do not have a significant surplus beyond 2025.
2. "Sewer limited" – towns that have a water surplus but do not have adequate sewer.
3. "Water and Sewer Capacity" – towns have significant surplus water and sewer. Reallocate growth into these (MWRA communities, Plymouth, Andover).

The resulting densities by zones are shown in the Water and Sewer Constrained Communities Map in Figure H-2.

Targeted Growth

This scenario builds around the values of the adopted land use plan (MetroPlan) for the Boston region. Development is focused to where infrastructure and the densest concentrations of population and employment already exist. Emphasis is

placed on communities with commuter rail stations.

Job allocation is the same as in the Water and Sewer Constraints scenario. This is to emphasize that the "excess above water capacity" jobs have been relocated to the area most able to accommodate them - the MWRA zone, which is also mostly served by transit and the radial commuter rail system.

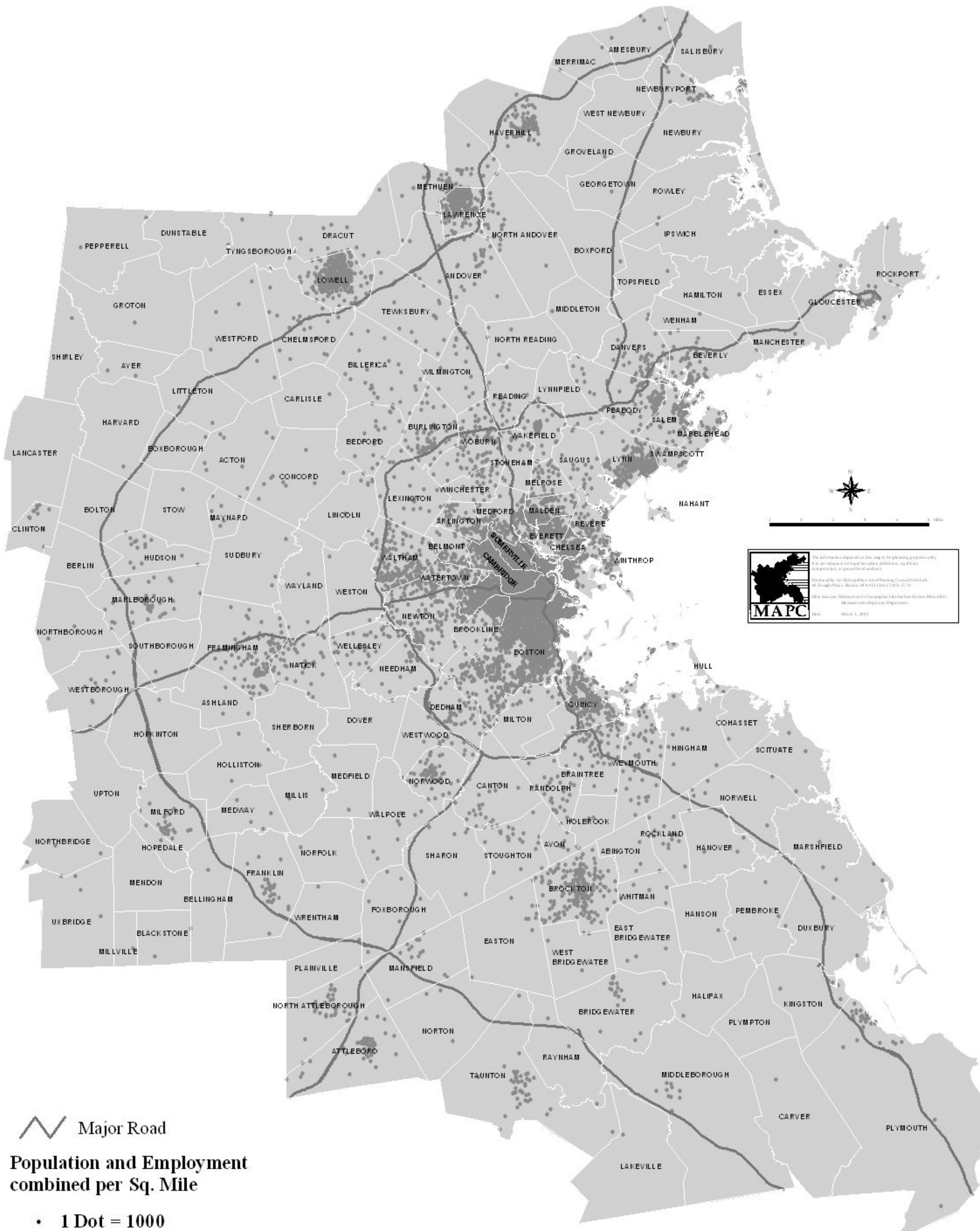
Growth in population and households by community is targeted based on the following principles:

- MWRA and Andover and Plymouth: Grow the same as in Water Constraint Scenario (i.e., Trends Extended plus 7% additional population growth)
- Areas with additional water capacity and either existing Density or a Commuter Rail station: Population to grow as in Water Constraint scenario, then add 5% more population (using the year 2000 as base population), but limit total growth to the water capacity level.
- Area with no additional water capacity and a Commuter Rail station: Since these areas are already water constrained, assume only an additional 3% growth (using the year 2000 as base population), and assume that this will be off-system growth or through water conservation measures.
- In areas with water capacity and with density and commuter rail: Population to grow as in Water Constraint Scenario and then add 10% more population (using the year 2000 as base population) but limit growth to water supply capacity.
- Non-water limited areas without density or commuter rail: Grow as in Water Constraint Scenario (i.e., to Trends Extended growth that is not limited by water).
- Water limited areas without commuter rail: Grow as in Water Constraint Scenario to limit of water availability.

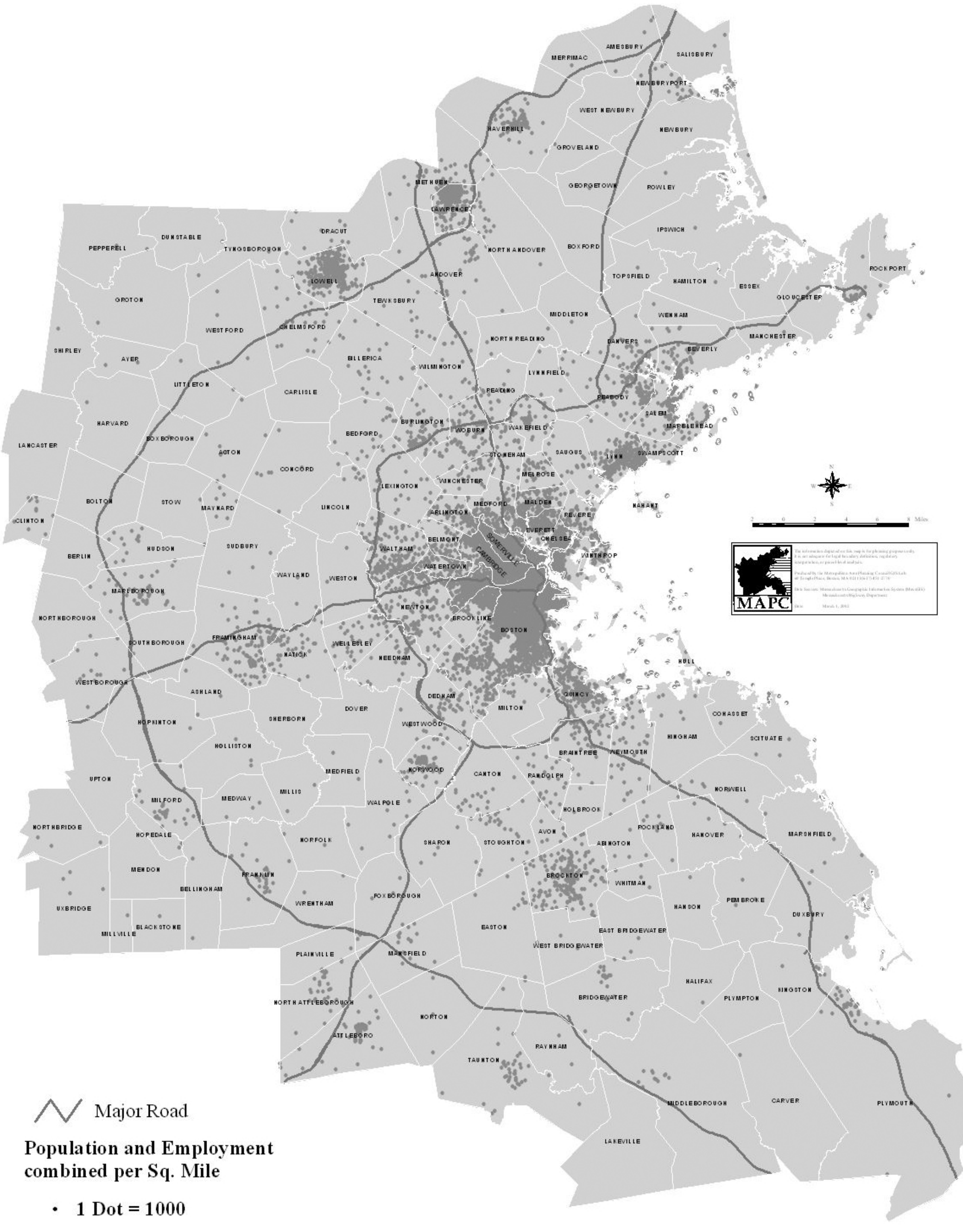
The above allocations allow regional population growth for 2025 to be larger than those under the previous two scenarios. The resulting population and employment densities under this scenario are displayed in the Targeted Growth Map in Figure H-3.

It should also be noted that none of these three land use scenarios incorporated the results of the community Build-Out calculations. Build-Out numbers could have been used as upper bounds on the growth potential of any community. However, Build Outs had not been completed for all communities at the time these forecasts were developed, so they were not applied to any communities for this plan.

Map H-1
Basic Forecast Map



Map H-2
Water and Sewer Map



MAP H-3
Targeted Growth Map